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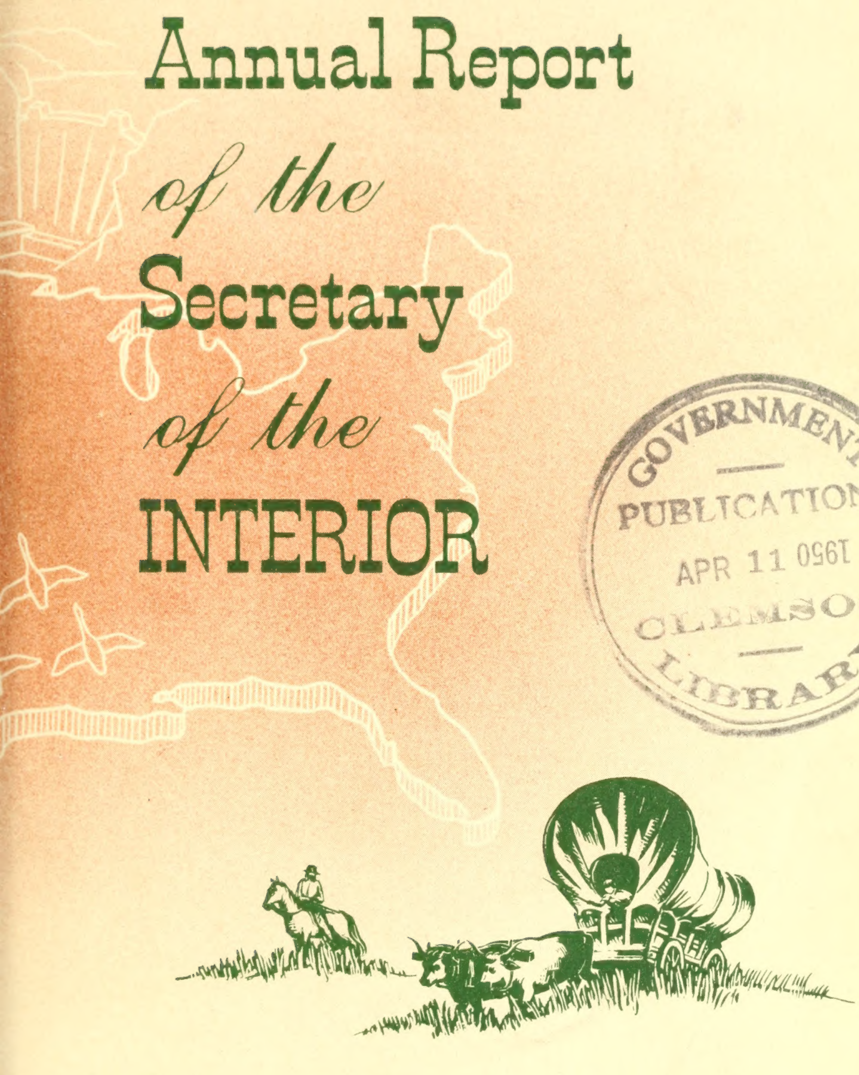

A Century of Progress, 1849-1949

Annual Report

# of the

Secretary of the Interior

DEPARTMENT OF THE INTERIOR
March 3, 1849

Fiscal Year Ended June 30, 1949

UNITED STATES
DEPARTMENT OF THE INTERIOR
OSCAR L. CHAPMAN, *Secretary*

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Letter of Transmittal
The Secretary of the Interior

Oscar L. Chapman, *Secretary*

* * *

My Dear Mr. President: I am transmitting herewith the reports of the agencies of the Department of the Interior for the 1949 fiscal year. These reports provide a remarkable documentation of the variegated role of government in a democracy. The reclamation of arid land, the production and marketing of hydroelectric power, the inventorying and evaluation of our physical resources, the development of the territories, research in biological resources, the health, education, and welfare of the Indians—these are just a few of the responsibilities of the Department on which we report this year. They are responsibilities fundamental to the well-being of our Nation. They are tasks which, when carried out, respond to needs which individuals are unable to provide for themselves, and yet which must be provided in order to assure the broad base which our national economy requires in order to function properly.

It is unnecessary to recount in this letter of transmittal the measures of progress of the Department of the Interior during the 1949 fiscal year. These are described adequately in the reports of the individual agencies which follow. Of more consequence is a brief account of the growth of the Department during its first century, the end of which was marked during this year, and some of its major contributions during this century. These 100 years have witnessed the unfolding of a new era. The industrial revolution erupted and spread its effects throughout the western world in this century. This Nation has made its contributions to these changes, and has been greatly affected by them. Our territorial growth, the phenomenal expansion of our population, the complexity and efficiency of our economic machine culminating in increase of almost a hundredfold in our national income since 1849 are a few indications of these changes. The evolution of the Department into a large and complex agency charged with the management and integration of a far-flung program of natural resource activities has, in effect, paralleled the growth of the Nation. It has been called upon repeatedly to take an active part in the development of this era of progress. Under a long succession of acts of the Congress it is charged with responsibility for administering a major share of the activities of the Federal Government that deal directly with the conservation and development of the resource base of our economy. Consequently, its activities affect directly the adequacy of that resource base to provide the raw materials which this Nation consumes in its expanding role in the political, social, and economic affairs of the world.

THE "MOTHER OF THE CABINET"

To have envisioned in 1849 the world of 1949 would have indeed required a rare facility of imagination. It is not surprising that the Department of the Interior in the administration of President Zachary Taylor, consisting of Secretary Thomas Ewing, a Chief Clerk and 637 employees little resembles the Department of today, with more than 50,000 employees and its wide range of interests. Although this early Department contained the germ of its present mission in its responsibilities for the public lands and the Indians, it was, despite its broad responsibility for promoting "the arts of peace and production," an administrative receptacle for a variety of public responsibilities—pensions, the census, patents to inventors, and other domestic activities. Through the years, the Department in effect, became the "Mother of the Cabinet." The Department of Agriculture originated as a bureau of the Department until it was elevated to Cabinet status in 1862. A Bureau of Labor was established in the Department and so existed until it acquired departmental status. Similarly, the Department of Commerce began as an agency of Interior, until it was merged with the Department of Labor into a Department of Commerce and Labor. Other agencies originated in the Department: the Veterans' Administration, the Office of Education, the eleemosynary institutions of the Federal Government. Suffice it to say that out of the diverse activities which have characterized the Department during the past century there has emerged a clearly understood departmental mission, a significant and comprehensive role for the Department to play in the affairs of the Nation. This mission, although originating in the responsibilities of the Department of 100 years ago for the custody of the public domain and the Indians, has been tempered by the times through which the Department, and the Nation, have passed. This mission has been shaped by the increasing awareness during the years that something must be done to conserve the resources of our vast national domain.

CONSERVATION ERA AND RESOURCE MANAGEMENT

At about the turn of the century strenuous efforts at conservation began, directed mainly toward slowing up the rate of disposition of natural resources and preventing their monopoly control. As a corollary to these efforts was the development of the sound concept that our renewable resources should be maintained on a sustained yield basis; and more recently the public recognition of the need for all-out development of unused resources to serve the need of an expanding national economy. The Reclamation Act of 1902 is an expression of this philosophy, although it reached its present stature many years later. In the 1920's and at an accelerated pace in the 1930's such forward looking resource management laws as the Mineral Leasing Act, the Taylor Grazing Act, and the Bonneville Act were adopted. In the late 1930's and the 1940's came the inception of vast multiple-purpose programs such as the TVA, the Missouri Basin, Columbia Basin, and Central Valley projects, programs which envisage the conservation and development of the total resources of great river basins.

ACHIEVEMENTS OF DEPARTMENT

It is appropriate to point out some of the products of the Department's work in its first 100 years:

Over 5,000,000 acres of arid and semi-arid lands in Western States have been made fruitful with irrigation water.

Hydroelectric plants with installed capacity of nearly 3 million kilowatts, 18 percent of the Nation's total utility hydroelectric supply, have been built.

Value of crops grown on federally irrigated land last year was more than $555,000,000 and power revenues another $32,000,000.

Federal mine inspection and mine safety programs have brought the death rate in coal mines down to 1.56 per million tons of coal mined. In 1910 when the Bureau of Mines was established the rate was 5.62 per million tons of coal mined.

Methods of making synthetic liquid fuels out of coal and shale have been developed and proven practical at costs approaching present natural liquid fuel costs.

The Department has developed the exclusive production of the national supply of helium in this country, one of the few known supplies in the world. New and important peacetime uses have been developed by the Department in addition to its use in medicine, including welding, and tracing of underground petroleum.

Extensive metallurgical research essential for industry and military purposes has been completed on hundreds of metals. Typical is the development of metallic titanium, which can be now used for construction equipment, machinery parts, and other uses. It is half as heavy as steel and twice as strong.

Conservation work in irrigation, forestry, and minerals was initiated by the Department. This resulted in later creation of the Forest Service of the Agriculture Department and the Bureau of Reclamation, Bureau of Mines, and the Bureau of Land Management of Interior.

Topographic and geologic maps have been prepared which have served as the basis for virtually all important detailed surveys in this country, and for important construction, public and private.

Accurate records have been maintained for approximately half a century on stream flow which allows prediction of flood conditions and planning of dams and levees. Over 5,000 stream gaging stations are now maintained by the Survey. Ground water studies have permitted cities and industries to locate and construct work for adequate water supplies and have warned of possible disaster in certain areas from a lowered water table.

The affairs of 400,000 Indians have been administered on more than 200 reservations. Education has been improved so that today about 62 percent of Indian children are in their proper school grade compared with 20 percent in 1928. Some 227 schools and 72 hospitals have been built and operated.

Twenty-eight national parks have been acquired and developed, including 11,347,269 acres which are being preserved for their beauty and public interest and recreation, and 146 national monuments, historic sites, and recreational areas.

Two hundred eighty-two wildlife refuges comprising 18,000,000 acres, have been acquired and developed for protection of wildlife and birds which were in danger of extinction.

A research program has been developed and administered for the $100,000,000 Alaskan salmon industry resource, so that future salmon runs would not be damaged.

From 1910 to date, the fur seal herd on the Pribilof Islands has been so managed as to increase it from 132,000 animals to more than 3,380,000.

The existing public domain has been managed for many years so as to make a profit for the Government over its own costs of operation.

Approximately 285,000,000 acres of public lands have been disposed of in Western States under homesteading laws which permitted wide settlement and later development of vast areas.

Cadastral surveys of 1 billion, 300 million acres of public lands have been made.

Grazing activities on western public lands have been administered through 58 grazing districts which permit orderly use of 154,000,000 acres of public land by private stockmen.

The Department serves as the Federal Government liaison and advisor for the nearly 3,000,000 American citizens who live outside the borders of continental United States. In addition, it has helped to secure equality of legislative treatment for residents of territories and insular possessions.

UNITY OF RESOURCES

In the development of the programs of this Department we have recognized that our land, water, and mineral resources must be regarded as a unity, and managed as a unity. These resources occur in the same land areas. Action taken, or the failure to take action, in one field inevitably affects other resource fields. The despoiling of timber lands in higher altitudes causes serious erosion and damaging floods. Overgrazing these lands may reduce the original capacity of water reservoirs. The development of phosphate deposits on the public lands may be completely dependent on the availability of hydroelectric power.

Although important resource development tasks of the Department are in the West, we have important work to do in every State and Territory of the Nation. Consider the geographic diversity of these functions. The Geological Survey works in every State and in all of the Territories. The Bureau of Land Management functions in 29 States and the Territories, wherever the Department has responsibility for federally owned lands. The National Park Service and the Fish and Wildlife Service serve the public—east and west—north and south. Similarly, the Bureau of Indian Affairs supervises the administration of the affairs of the Indians in the East as well as the West and Alaska.

The Bureau of Mines' valuable projects are carried out in Alaska, Pennsylvania, Arizona, and Alabama—in fact in every State in which there is a present or future prospect of mineral development—east and west of the Rockies. In the public power field progress has been made in the regional agencies—Bonneville in the Northwest, the Southwest Power Administration, and we have begun to market power in the Southeast. Only in the case of our reclamation activities are we restricted to the West by law at this time. All in all—our 50,000 employees work in 1,500 offices distributed through the 48 States and Territories.

LOOKING TOWARD THE FUTURE

We cannot afford today to look back and predicate our future actions on past accomplishments. It is essential that we look forward, and rely on the past only as the provider of experience with which to anticipate the requirements of the future. We recognize today the vital link between our natural resources and the requirements of our expanding economy and national security. We are attempting to inform the Nation of these relationships of the need for protection of nonrenewable resources and for a sustained yield plan for renewable resources. We have stressed the necessity for developing processes for utilizing lower-grade minerals, and the need for guarding our scenic and historic areas against commercial exploitation, the necessity for expanding our land base by irrigation, and the urgent necessity for meeting critical expanding energy needs.

You have provided a goal to which our sights must be raised. Your economic report to the Congress discussed at considerable length the prospects for national economic growth and pointed out that national production could increase by 3 or 4 percent each year over the next few years. This amounts to an increase of about one-third over the next decade. This forecast of increase in national output is based on the prospect of gain in output for each individual worker—for, although the number of employed may increase over the next few years, the average work week may become shorter. This increase in man-hour productivity will come about from equipping workers with more and better tools which use greater volumes of energy.

INTERIOR'S ROLE IN THE FUTURE

The Interior Department bears a heavy responsibility for assuring that technical progress, on which increased productivity is dependent, is made possible. To a considerable extent Interior's activities determine whether the additional metals, the timber, chemicals, and power from which the tools and energy are produced will be at hand. Interior does not supply all of these products by itself, of course, but it plays an indispensable role in their production. For example, Interior's geologic mapping and exploration are prerequisite to mineral discovery, its research and development activities are essential to encouraging increased mineral output and to providing substitutes for scarce materials, we must assist in usefully developing the energy in our rivers and must market it wisely if the large increment of necessary electrical energy is to be available, and Interior must see to it that the wealth in public lands is made available for wise use. The programs of the Department directed toward these purposes are truly investments by the Nation in its future well-being. It is our job to manage these investments wisely.

In looking forward to the jobs which we are obligated to undertake if we are to realize the national economic and social potentials, a few of the tasks in which the Department of the Interior must share are listed:

To do its part in meeting the long-range energy requirements of the economy, the Federal Government should develop by 1970, 30 million of the 77 million kilowatts of economic hydroelectric power potential contained in our rivers. Despite progress to date, we have developed less than 20 percent of this potential hydroelectric power. In addition, research in long-distance power transmission should be encouraged. A Federal program to produce electric power from atomic energy should be continued, and research to produce heat from solar energy and the heat pump and to produce power from the wind should be accelerated.

Future population growth, particularly in the West, and significantly enhanced living standards will require enlarged output from our agricultural plant. The Department's program for reclaiming land by irrigation will contribute to this national need. Our long-range program provides for the new irrigation of 17.7 million acres and the supplemental irrigation of 9.1 million acres by 1977. Even this program may fall short of requirements.

The Department of the Interior administers more than 200 million acres of range land in the West. Fully half of this range needs restorative work. Twenty-two million acres need reseeding now; 15 million acres are partially or entirely unusable now without further water development. To do the job within 20 years will require an annual rate of expenditure nearly triple the Department's expenditures for 1949. This resource, improved, adds to the agricultural plant of the United States, fundamental to the production of meat, wool, and hides. Well managed, with proper conservation of soil and cover, it contributes a supply of clear water, evenly distributed, to multiple-purpose reservoirs. Neglected, it adds to the devastation of floods and rapidity of siltation of reservoirs.

We must complete the geologic mapping of the areas of the country still unmapped.

Develop adequate perpetual reserves of timber for commercial cutting; replant and reseed hundreds of thousands of acres of forest lands under Interior supervision; increase fire and disease protection.

A rigorous research program should be initiated for making economically feasible the large-scale reclamation of water from the ocean, through distillation or other means.

These selected objectives are illustrative of the relationship between the work of this Department and affirmative national policies and programs to promote long-term economic growth. It is our intention, as the Department of the Interior enters on its second century, that its record of accomplishment during this century will be measured by the extent to which it participates in anticipating the needs of a healthier, happier, and wealthier America.*

Oscar L. Chapman

Secretary of the Interior.

**During the period covered by this report J. A. Krug was Secretary of the Interior.*

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Bureau of Reclamation

Michael W. Straus, *Commissioner*

DESIGN AND CONSTRUCTION

AN ALL-TIME RECORD construction program for development of irrigable lands and expansion of hydroelectric facilities on projects throughout 17 Western States was accomplished by the Bureau of Reclamation during fiscal year 1949. This program, representing a widely diversified undertaking of design and construction of dams, canals, power plants, pumping plants, transmission lines, and other important features intrinsic in the Bureau's projects, was by far the largest in Bureau history. Embracing an expenditure of almost 250 million dollars, the 1949 program was more than 40 percent greater than the 1948 program.

Included in the 1949 program was the continued expansion of construction on the largest of the Bureau's basin-wide developments, the Missouri River Basin project; the start of major construction activity at Hungry Horse Dam, largest concrete dam now being built; and the continuance of construction of important irrigation and power features on the Columbia Basin, Central Valley, Colorado-Big Thompson, and other projects.

A significant development during the year was the leveling-off of construction costs and increased rate of accomplishment by contractors' forces. Notable also was the general willingness of contractors to submit more competitive bids.

Noteworthy progress in research on materials of construction during the last year indicated substantial savings could be realized on structures which are now under construction and on those which are to be undertaken in the future. These savings are accomplished by improved use of construction materials and new methods of construction.

Contract Awards

Major contracts awarded during the year included construction of Canyon Ferry Dam in Montana, Cedar Bluff Dam in Kansas, and Bonny Dam in Colorado. The largest award of the year was made for the completion of the Grand Coulee pumping plant and miscellaneous construction work at Grand Coulee Dam in Washington.

The total value of the more than 800 construction, material, equipment, and supply contracts awarded during fiscal year 1949 amounted to about 163 million dollars. Of the total contract amount, construction contracts accounted for 139 million dollars or about 85 percent. By comparison, construction contracts awarded during the previous year amounted to approximately 105 million dollars. A summary of the major contracts awarded during fiscal year 1949 is given in table 1.

TABLE 1.—*Major Bureau of Reclamation contracts awarded in fiscal year 1949*

Feature	Project	Amount of award
Completion of Grand Coulee pumping plant and miscellaneous construction work at Grand Coulee Dam.	Columbia Basin	$13, 348, 419
Canyon Ferry Dam and power plant	Missouri River Basin	11, 896, 425
Cedar Bluff Dam	do	11, 350, 735
Bonny Dam	do	10, 301, 653
16 miles East Low Canal and 6 miles Rocky Coulee Wasteway.	Columbia Basin	8, 029, 762
2.5 miles Soap Lake siphon	do	7, 614, 728
27 miles Friant-Kern Canal	Central Valley	7, 494, 372
17 miles West Canal	Columbia Basin	6, 136, 234
Generators for units R-7, R-8, and R-9 at Grand Coulee Dam.	do	5, 250, 034
Shadehill Dam	Missouri River Basin	5, 116, 796
North Coulee Dam and 2 miles feeder canal	Columbia Basin	4, 718, 725
15.6 miles Delta-Mendota Canal	Central Valley	4, 165, 764
14.8 miles Delta-Mendota Canal	do	3, 679, 107
Platoro Dam	San Luis Valley	2, 727, 792
Turbines for units R-7, R-8, and R-9 at Grand Coulee Dam	Columbia Basin	2, 497, 950
5.5 miles Salt Lake Aqueduct	Provo River	2, 429, 201
7 miles Horsetooth Feeder Canal	Colorado-Big Thompson	2. 369, 654
Turbines for units A-3, A-4 for Hoover power plant	Boulder Canyon	2, 080, 100
Unit 6, Coachella Valley distribution system	All-American Canal system	2, 049, 922

Construction Progress

At the end of the year, construction was in progress on 23 storage dams and 1 diversion dam, 9 power plants, 22 pumping plants, 440 miles of main canals, and 1,600 miles of transmission lines.

The rate of construction progress on many projects was greater than had been anticipated. For example, the construction of Jackson Gulch Dam on the Mancos project in Colorado was scheduled for completion by April 1950 but was actually completed in December 1948. By the end of the fiscal year, construction on O'Sullivan Dam on the Columbia Basin project was virtually completed with only 62 percent of the contract time elapsed; thus completion was approximately 18 months earlier than was required by the contract.

A significant increased rate of accomplishment on Bureau of Reclamation projects was made during the year. Notable was the increased rate of progress of placement of earth fill in dams, excavation for large canals, and lining of canals. The trend toward acceleration in monthly placement quantities in earth-fill dams was particularly outstanding. This increase in placement quantities was attributed to three major factors: more efficient use of older types of earth excavating and transporting equipment, production of larger capacity models of such equipment, and development of new machines and procedures. The high rate of accomplishment on Bureau projects has required revisions in payment schedules on some projects. As a result, supplemental funds were needed to continue the rapid pace of construction.

During the year, the main embankment of Davis Dam was completed. What is believed to be a record for earth placing operations on a Bureau project was established at this dam during February 1949 with the placement of 770,000 cubic yards of material in the 3,500,000-cubic-yard embankment.

Excavation work continued on Hungry Horse Dam, largest of Bureau dams under construction. Installation of equipment for handling aggregate and concrete was in progress to facilitate initial placement of concrete by the fall of 1949. Work on the principal contract for the construction of Boysen Dam and power plant was about 60 percent complete by the end of the fiscal year as compared with 43 percent of the contract time elapsed.

Principal Features Completed

Principal features completed on Bureau projects this year are shown in table 2.

TABLE 2.—*Principal features completed on Bureau of Reclamation projects in fiscal year 1949*

Feature	Project	State
Jackson Gulch Dam	Mancos	Colorado.
Cascade Dam	Boise	Idaho.
Long Lake Dam	Columbia Basin	Washington.
Olympus Dam	Colorado-Big Thompson	Colorado.
Horsetooth Reservoir Dams	do	Do.
Cambridge diversion dam	Missouri River Basin	Nebraska.
Heart Mountain power plant	Shoshone	Wyoming.
Aspen Creek siphon	Colorado-Big Thompson	Colorado.
Prospect Mountain conduit	do	Do.
Phoenix-Tucson No. 2 transmission line	Davis Dam	Arizona-Nevada.

Continuing Program

The structures tabulated in table 3 are among the major features expected to be placed under construction on Bureau of Reclamation projects during fiscal year 1950. Major features of Bureau projects expected to be completed in fiscal year 1950 are indicated in table 4. Approximately 560 miles of transmission lines and over 150 miles of canals now under construction are expected to be completed during fiscal year 1950.

TABLE 3.—*Major features expected to be placed under construction on Bureau of Reclamation projects in fiscal year 1950*

- Missouri River Basin project:
  - Keyhole Dam, S. Dak
  - Anchor Dam, Wyo.
  - Tiber Dam, Mont.
  - Missouri Diversion Dam, Mont.
  - Trenton Dam, Nebr.
  - Narrows Dam, Colo.
  - Red Willow Diversion Dam, Nebr.
  - Cambridge Canal, Nebr.
  - Courtland Canal, Nebr.
  - Boysen-Alcova transmission line, Wyoming.
  - Thermopolis-Lovell transmission line, Wyoming.
  - Havre-Shelby transmission line, Montana.
- Colorado-Big Thompson project:
  - Carter Lake Dam, Colo.
  - North Poudre Diversion Dam, Colo.
  - Pole Hill and Olympus Tunnels, Colo.
  - Carter Lake Pressure Tunnel, Colo.
  - Willow Creek Canal, Colo.
  - North Poudre Supply Canal, Colo.
  - St. Vrain Supply Canal, Colo.
  - Colorado-Big Thompson transmission lines, Colorado.
- Central Valley project:
  - West side transmission lines, California.
- Santa Barbara project:
  - Cachuma Dam, Calif.
  - Tecolote Tunnel, Calif.
  - South coast irrigation and water supply conduit, California.
- Columbia Basin project:
  - East Low Canal, Wash.
  - Potholes East Canal, Wash.
  - West Canal, Wash.
  - Laterals to serve 87,000 acres, Washington.
- Provo River project:
  - Murdock Diversion Dam, Utah.
  - Duchesne Diversion Dam and Duchesne Tunnel, Utah.
- Riverton project:
  - Muddy Ridge Canal, Wyo.
- Paonia project:
  - Fire Mountain Canal, Colo.
- Gila project:
  - Pumping plants 1, 2, and 3, Wellton-Mohawk Canal, Ariz.
- Davis Dam project:
  - Davis Dam, Prescott-Mesa and Mesa-Coolidge transmission lines, Arizona-Nevada.
  - Davis Dam-Hoover Dam, and Davis Dam-Parker Dam transmission lines, Arizona-Nevada.

TABLE 4.—*Major features on Bureau of Reclamation projects expected to be completed in fiscal year 1950*

Feature	Project	State
Enders Dam	Missouri River Basin	Nebraska.
Medicine Creek Dam	do	Do.
Angostura Dam	do	South Dakota.
Gering-Sidney transmission line	do	Nebraska.
Gering-Alliance transmission line	do	Do.
Williston-Garrison Dam transmission line.	do	North Dakota.
Granby Dam	Colorado-Big Thompson	Colorado.
South Coulee Dam	Columbia Basin	Washington.
Rehabilitation of Pathfinder Dam	North Platte	Wyoming.
Keswick power plant	Central Valley	California.
Second Parker-Gila transmission line	Davis Dam	Arizona-Nevada.
Fort Peck-Williston transmission line	Fort Peck	North Dakota.
Canals, laterals, drainage	Tucumcari	New Mexico.

Cost Trends

Costs of both material and labor, which have shown a continuous increase since 1940, appear to have reached a peak during the last half of 1948. Bureau of Reclamation construction cost indexes in most categories, as illustrated in table 5, indicate a slight decline in costs of the principal types of Reclamation work for the period ending June 30, 1949. It will be noted, however, that one type of work actually increased while four others remained the same as in January 1949. An

TABLE 5.—*Bureau of Reclamation construction cost indexes—fiscal year 1949*

Cost indexes based on January 1940 costs=1.00	July 1948	January 1949	June 1949
Dams:			
Earth	2. 15	2. 25	2. 15
Concrete	2. 00	2. 10	2. 15
Pumping plants:			
Building	2. 35	2. 45	2. 30
Equipment	1. 80	1. 80	1. 75
Discharge pipes	2. 25	2. 40	2. 10
Canals and conduits:			
Canals	2. 30	2. 35	2. 30
Conduits	2. 20	2. 30	2. 30
Laterals and drains	2. 45	2. 45	2. 45
Powerplants, hydro:			
Building	2. 30	2. 40	2. 30
Equipment	1. 75	1. 75	1. 75
Penstocks	2. 25	2. 40	2. 10
Transmission switchyards and substations	1. 80	1. 80	1. 75
Transmission lines (wood pole)	2. 50	2. 40	2. 35
Roads and bridges:			
Primary roads, surfaced	2. 10	2. 20	2. 20
Secondary roads, unsurfaced	2. 20	2. 25	2. 15
Bridges	2. 20	2. 30	2. 25
Composite index	2. 15	2. 20	2. 20

easing in the tightness of the supply of materials accompanied by a decline in the cost of some materials and a noticeable increase in labor efficiency and in the number of bidders on Reclamation work were evident during the year. These factors were offset, however, by increases in labor rates as a result of certain classes of labor receiving wage increases and in the readjustment of minimum wage rates. As a result, there was a leveling-off of construction costs rather than a sharp decline.

During the year a definite increase was noted in the number of bidders on most Bureau work. This has resulted in some instances in lower bids being received. Also noted was the smaller spread between the high and low bids, indicating that contractors were computing their estimates more closely. For example, bid openings for construction of transmission lines covering identical work previously advertised showed not only a large increase in the number of bidders but also bids from 4 to 30 percent lower than those received during the preceding year. While this reflects to a large extent the availability of transmission-line materials, it also indicates in general a willingness on the part of contractors to submit really competitive bids. Contractors are now more willing to accept contracts without including in their bids large contingency items to cover every possible expenditure.

Force Account

The amount of force-account work performed by the Bureau was within legislative limitations and represented a negligible proportion of the total construction work accomplished during the fiscal year. However, minor construction activities by means of force-account work were carried out on some projects. These activities ranged from operation of a sawmill at Keswick Dam to installation of electrical equipment on various projects after the major construction was completed.

Standard Specifications

This year the Branch of Design and Construction initiated the use of standard specifications for construction of canal systems which has as its objective the elimination of duplicate material and the expediting and review of specifications of structures of similar nature. Specifications for canals, laterals, and similar structures were published and issued under this plan. Also, a volume of standard specifications and drawings for H-frame, wood-pole transmission lines was prepared and used during the year.

As an example of measures taken to attract more and possibly lower bids, the readvertisement for Canyon Ferry Dam and power plant contained a provision allowing the contractor to obtain monthly payment for 85 percent of his investment in special concrete plant and equipment. The payments to the contractor were to be repaid to the Government by deductions from the contractor's earnings at a specified rate per cubic yard of concrete placed in the dam.

In construction specifications, provisions were included, when practicable, to provide for the contractor to prepare reinforcement-bar detail drawings. This method was inaugurated in the specifications for the construction of pipe lines on unit 6 of the Coachella Valley distribution system.

A procedure for supplying duplicate bidding schedules to bidders on both supply and construction specifications was inaugurated. By use of this procedure, the bidder can retain a copy of the specifications for his records and submit his bid on the duplicate bidding schedule and accompanying forms.

Four hundred and thirty specifications for both construction and long-form supply contracts were reviewed and issued by the Branch of Design and Construction this year.

Staff Development Program

A staff development program inaugurated this year by the Branch of Design and Construction aimed at providing new employees broader knowledge of the Bureau's activities and giving young engineers an opportunity to obtain diversified experience in the various design, research, and construction functions of the branch. New employees rotate from one assignment to another, receiving valuable training under the guidance of experienced Bureau engineers. Participants remain in this program for approximately 2 years, gaining at least

6 months of design experience, 3 months of research experience, and 3 months of field experience during the first year. During the second year of the program, the participants are given an opportunity to specialize in the field of work for which they are best qualified. Concurrently with the work experience program, supplementary instruction is given by technical specialists in the Branch of Design and Construction.

To assure the satisfactory service condition and functioning of Bureau of Reclamation structures and facilities at all times, a program of inspection and preparation of operators' instructions was initiated. Principal objectives of the program are the verification of the safety of the works or disclosure of unsafe conditions; verification of the adequacy of the works in their current condition to meet operating requirements; and the utilization of the service experience for the improvement of design and construction practices.

Engineers in the Branch of Design and Construction participated in many activities of professional engineering societies, including the American Society of Civil Engineers, the American Society of Mechanical Engineers, the American Society for Testing Materials, the American Institute of Electrical Engineers, the American Concrete Institute, and the Geological Society of America. Besides serving as members on important committees of these societies, the engineers presented over 35 technical papers at various meetings of the societies.

Bureau engineers actively participated also in the affairs of several international professional organizations. Technical papers by these engineers were prepared for such organizations as the International Assembly of Scientific Hydrology and Geophysics, the Pan American Engineering Congress, and the International Conference on Large Electric High Tension Systems.

Research

Research, geologic investigations, and testing activities of the Denver research laboratories were intensified as many new features of Bureau projects entered design and construction phases. Major activities in the laboratories included the testing of construction materials, such as cement, aggregate, soils, and protective coatings of metalwork, the verification of design through the use of structural and hydraulic models, and the appraisal of foundation conditions and structure sites. Noteworthy progress was made in the fields of special experimentation wherein new techniques and procedures could be utilized in the solution of future research problems.

Hydraulic studies were completed on the determination of the location of the Delta Cross Channel which is to effect the transfer of water from the Sacramento River to the San Joaquin River on the

Central Valley project. Investigations advanced materially in the measurement and prevention of water seepage from canals. Research directed toward the development of more effective and cheaper canal linings culminated in several test installations of buried asphalt membrane and in the development of rapid and inexpensive placement of concrete linings by the use of relatively simple equipment.

Research toward the continued improvement of the protection of metal linings of pipes and conduits was exemplified by the application of 24 test sections of various protective coatings to the penstocks of Shasta Dam. The first Bureau installation using cathodic protection, an electrical method for preventing corrosion on metalwork, was made on two steel water tanks on the Boulder Canyon project.

Research in control of weeds in canals was noteworthy for the development of a new "slug treatment" by which large quantities of weed killer could be applied for a short period to water in the weed-infested canals. Investigations were made for the control of algae infestations of hydraulic works, and tests were performed on the effect of weed killers upon crop growth.

The method devised in the Denver laboratories for measurement of residual stresses in rocks exposed in tunnels and excavations was further developed. Studies made on the pressure of ice on dams and other structures led to increased knowledge that will be of great usefulness in the design and construction of future projects.

Studies of cavitation and protection measures for the avoidance of this damaging effect upon hydraulic structures were continued. Experimentation was directed also toward improved design of reinforced concrete and the better utilization of new types of reinforcement steel. Investigations of the physical properties of loess soils and their possible utilization as foundation and construction materials on structures in the Missouri River Basin were undertaken. Studies were made also on the design of satisfactory concrete mixes that include the inferior aggregates of the Kansas-Nebraska region.

Notable new developments in geological and related studies were made through the application of geophysical techniques in the study of foundations and construction materials available at construction sites. Research was carried out on ground-water investigations, and studies were made of the permeability of rocks and soils as well as of the effect of expansive pressures exerted on structures by certain types of foundation clays.

The effectiveness of the research and testing facilities of the laboratories was greatly enhanced during the year by the installation of special equipment, including a flame photometer for use in the chemical analysis of engineering materials, X-ray diffraction apparatus for quicker and more detailed study of soils, minerals, and other substances, and equipment for the identification of materials by the method of differential thermal analysis. Installation of a new 5-million-pound testing machine was begun. This huge machine, when installed, will permit more extensive experimentation and research on large specimens and structure models than was previously possible.

An important research accomplishment was the culmination of studies on the use of pozzolanic materials in concrete structures. Although these studies have not been completed, they have progressed sufficiently to indicate that about 30 percent of the cement in the concrete for Hungry Horse Dam could be replaced by fly-ash (an inexpensive waste product of coal-burning boilers). Not only will an improved concrete result through the use of this material, but substantial savings will be realized on this dam and similar concrete structures to be undertaken in the future.

Work Performed for Other Agencies

As a result of its preeminence in the field of design and construction of structures of unprecedented size and complexity, the Bureau has been called upon for assistance from outside agencies and other Government departments. By agreement with the International Boundary and Water Commission, the Bureau engaged in the preparation of detailed designs and specifications for the Falcon Dam which is to be built by the Commission on the Rio Grande River about 60 miles downstream from Laredo, Tex., as provided by the Water Treaty of 1944 between the United States and Mexico. During the year, alternate preliminary designs and estimates were prepared and presented at a joint conference in Denver, from which a final design scheme was selected. Following selection of final design of the dam, rapid progress was made in preparation of detail designs and specifications to arrive at allocable costs, and a design feature report was furnished to the Boundary and Water Commission. Bureau engineers attended several conferences with the United States section of the Commission, and three joint conferences were convened to implement the work so that the completion of construction as provided by the treaty could be accomplished by 1953.

Under a contract with the city of Seattle, Wash., the Bureau's Denver laboratories conducted tests on the determination of creep factors in mass concrete specimens from Ross Dam. In connection with this work, field data on temperature, stress, and strain measurements of the mass concrete in the dam were obtained.

Other work performed in the laboratories for outside agencies included concrete investigations for the Corps of Engineers, lightweight concrete tests for the Housing and Home Finance Agency, aggregate and concrete durability tests for the Atomic Energy Commission, aggregate and riprap studies and geologic investigations for the

Bureau of Indian Affairs, tests of wood preservative for the Forest Service, aggregate and concrete durability studies for the Puerto Rico Water Resources Authority, aggregate studies for the Tennessee Valley Authority, and concrete studies and hydraulic model testing for the Salt River Valley Water Users Association. A cooperative program of investigations of lightweight concrete, performed in conjunction with the Housing and Home Finance Agency, was brought to a successful conclusion.

During the year Bureau of Reclamation mapping activities and particularly those using aerial photography were coordinated with the programs of such primary mapping agencies as the Geological Survey to insure that no duplication occurred. Other agencies included the Army Map Service, Coast and Geodetic Survey, and Soil Conservation Service. Contracts for aerial photography and mapping were awarded by the Bureau for areas in California, Montana, New Mexico, Texas, and Utah, where urgent requirements could not be met by the primary mapping agencies.

Coordinative seismological studies with the United States Coast and Geodetic Survey and the National Park Service at Hoover, Shasta, and Hungry Horse Dams were continued and expanded during the year to meet requirements of the Bureau and the Coast and Geodetic Survey.

Twenty new inventions were reported by employees of the Bureau of Reclamation, and patents were granted on three devices which were previously reported.

International Cooperation

Technical assistance to foreign countries given by the Bureau of Reclamation in the various fields of water resources use and development including irrigation, hydroelectric power, drainage, and comprehensive basin development was furnished in four general categories.

Under authority of Public Law 402, Eightieth Congress, in-service training was given to 53 young engineers from seven foreign countries, the period of training averaging approximately one year. These were all class B grants (Public Law 402), each handled individually with costs being borne by the countries concerned.

In response to specific requests or in accordance with established exchange arrangements, approximately 2,000 items of technical data and publications pertaining to Bureau methods and practice were distributed to individuals and agencies of foreign governments.

The Bureau furnished advice and consultation to some 600 engineers, professors, and responsible officials from 56 foreign countries in matters related to development of water resources. Visits by these people varied in length from a day or two to several weeks. Advice and consultation were given in respect to specific projects in some cases and in regard to a wide range of subjects in others. Requests for these visits were received through the Department of State and assistance was given under provisions of Public Law 402. Where detailed advice and consultation were given, costs were borne by the country concerned.

Typical of the many requests for Bureau engineering assistance on foreign work was the request from the Economic Cooperation Administration that Bureau engineers review the plans for the proposed Fasideri Dam in Greece. In consultation with two engineers from Greece, engineers in the Branch of Design and Construction suggested changes in the design of the dam and made specific recommendations for modifications in the basic designs.

Through arrangements with a consulting engineering firm in the United States, the Bureau engineers undertook the highly complex problem of analyzing the stresses for the 850-foot-high concrete Kosi Dam which is to be constructed by the Indian Government.

Materials testing, hydraulic model investigations, and other studies made in the Denver laboratories of the Bureau were undertaken for several foreign agencies, including those of India, Colombia, Portugal, and Greece.

The Bureau is receiving increasingly numerous inquiries by mail from individuals in foreign countries requesting engineering data on a diversity of highly complex problems. Questions received concerned such topics as the selection of turbines for hydroelectric generating plants, techniques and methods for lining canals, design of earth dams, and design of irrigation distribution systems.

Experienced engineers were lent to various foreign governments in connection with water resources development. Requests for these assignments were received through the Department of State and were made under provisions of Public Law 402, Eightieth Congress, with recipient countries bearing the costs. Foreign assignments varied from 2 months to 1 year. Countries receiving this type of assistance were Ceylon, Colombia, India, Japan, Southern Rhodesia, and Venezuela. In addition, Bureau engineers were lent to ECA to assist in its reclamation programs in Greece and Italy.

As official representatives of the United States Government, Bureau engineers attended international engineering conferences at Cairo, Egypt; Rotterdam, Holland; Paris, France; and Stockholm, Sweden. Delegates to the Rotterdam and Stockholm conferences also visited Paris where they furnished advice and consultation to the Administrator, ECA, on important engineering problems. One delegate represented the Bureau of Reclamation at an international engineering conference in Rio de Janeiro.

TABLE 6.—*Bureau of Reclamation dams*

State and project	Name of dam	River	Type	Capacity	Height	Length	Volume	Year
Arizona:								
Salt River	Bartlett	Verde	Concrete multiple-arch	[2] 179, 500	287	1, 063	182, 000	1939
	Cave Creek [1]	Cave Creek	do	11, 000	109	1, 648	18, 775	1923
	Horse Mesa	Salt	Concrete arch, powerplant	[2] 245, 100	300	803	162, 000	1927
	Mormon Flat	do	do	[2] 57, 900	224	505	59, 900	1925
	Roosevelt	do	Masonry arch-gravity, powerplant.	[2] 1, 398, 000	280	1, 125	355, 800	1911
	Stewart Mountain	do	Concrete arch, powerplant	69, 800	207	1, 260	120, 500	1930
Arizona-California:								
Parker Dam power	Parker [1]	Colorado	do	717, 000	320	856	380, 000	1938
Arizona-Nevada:								
Boulder Canyon	Hoover (Boulder)	do	Concrete arch-gravity, 2 powerplants.	31, 142, 000	726	1, 244	4, 400, 000	1936
Davis Dam	Davis	do	Earth, powerplant	1, 820, 000	200	1, 600	4, 357, 500	(4)
California:								
Central Valley	Friant [1]	San Joaquin	Concrete gravity	521, 000	319	3, 488	2, 135, 000	1942
	Keswick [3]	Sacramento	do	23, 800	159	1, 046	197, 000	(4)
	Shasta	do	Concrete curved-gravity, embankment wing, power plant.	4, 493, 000	602	3, 460	6, 541, 000	1945
	Martinez	Offstream	Earth		38	1, 200	183, 450	1947
Orland	East Park	Little Stony Creek	Concrete arch-gravity	51, 000	139	226	15, 745	1910
	Stony Gorge	Stony Creek	Concrete slab-and-buttress	[2] 50, 200	139	868	43, 100	1928
Colorado:								
Colorado-Big Thompson	Dixon Canyon	Offstream	Earth	(5)	240	1, 215	3, 004, 000	1949
	Granby	Colorado	do	546, 000	245	885	2, 901, 300	1949
	Green Mountain	Blue	Earth, powerplant	154, 600	300	1, 150	4, 406, 000	1943
	Horsetooth	Offstream	Earth	147, 000	150	1, 610	1, 890, 000	1949
	Marys Lake [3]	do	Earth (2 dikes), power plant	700	40	1, 300	60, 500	(4)
	Olympus [1]	Big Thompson	Concrete gravity, embankment wing.	2, 850	60	1, 850	300, 000	1949
	Shadow Mountain	Colorado	Earth	15, 000	44	600	210, 000	1946
	Soldier Canyon	Offstream	do	(5)	220	1, 420	3, 288, 000	1949
	Spring Canyon	do	do	(5)	215	1, 115	2, 213, 000	1948
Fruit Growers	Fruit Growers	Alfalfa Run	do	4, 600	55	1, 520	135, 500	1938
Mancos	Jackson Gulch	Offstream	do	10, 000	181	1, 895	1, 988, 000	1948
Pine River	Vallecito	Pine	do	129, 700	162	4, 010	3, 738, 000	1941
Uncompahgre	Taylor Park	Taylor	do	[2] 106, 200	206	675	1, 115, 100	1937
San Luis Valley	Platoro	Conejos	do	67, 000	155	1, 525	940, 000	(4)
Idaho:								
Minidoka	American Falls	Snake	Concrete gravity, embankment wings.	[2] 1, 700, 000	94	5, 227	313, 600	1927
	Jackson Lake	do	do	[2] 847, 000	70	4, 920	491, 700	1911
	Minidoka [1]	do	Earth with concrete power house section, power plant.	[2] 95, 200	86	4, 475	257, 300	1906
	Grassy Lake	Grassy Creek	Earth	15, 500	118	1, 170	541, 600	1939
	Island Park	Snake, Henrys Fork	do	127, 600	91	9, 448	464, 000	1938

Idaho-Oregon:								
Boise	Anderson Ranch	Boise, North Fork	Earth, power plant	493,200	456	1,350	9,653,300	(4)
	Arrowrock	Boise	Concrete arch-gravity	[2] 286,600	354	1,150	636,000	1915
	Cascade	Payette, North Fork	Earth	700,000	107	785	395,000	1948
	Deadwood	Deadwood	Concrete arch	164,000	165	749	56,400	1931
	Deer Flat, Upper	Offstream	Earth	190,100	74	4,000	1,245,000	1908
	Deer Flat, Lower	do	do		46	7,200	1,240,000	1908
	Deer Flat, Middle	do	do		16	950	22,500	1908
Kansas:								
Cedar Bluff (Missouri River Basin).	Cedar Bluff	Smoky Hill	do	368,100	103	11,000	8,917,000	(4)
Kansas-Colorado:								
St. Francis (Missouri River Basin).	Bonny	South Fork, Republican	do	175,000	160	9,265	8,530,000	(4)
Montana:								
Bitterroot	Como	Rock Creek	do	34,800	65	2,550	1,106,000	1910
Hungry Horse Dam	Hungry Horse	Flathead, South Fork	Concrete arch-gravity power plant.	3,500,000	564	2,115	2,900,000	(4)
Huntley	Anita	Offstream	Earth	[2] 400	42	1,050	142,800	1937
Milk River	Fresno	Milk	do	129,100	111	2,070	2,105,000	1939
	Nelson	Offstream	Earth (5 dikes)	85,500	28	9,900	232,600	1915
	Sherburne Lakes	Swiftcurrent Creek	Earth	[2] 66,100	96	1,086	227,600	1921
Sun River	Gibson	Sun, North Fork	Concrete arch	[2] 105,000	196	960	167,500	1929
	Pishkun	Offstream	Earth (8 dikes)	46,400	50	9,180	599,300	1921
Canyon Ferry (Missouri River Basin).	Willow Creek	Willow Creek	Earth, semihydraulic fill	[2] 32,400	93	650	254,186	1911
	Canyon Ferry	Missouri River	Concrete, gravity	2,050,000	220	1,010	455,600	(4)
Nebraska:								
Frenchman-Cambridge (Missouri River Basin).	Enders	Frenchman Creek	Earth	74,000	134	2,603	1,951,000	(4)
Mirage Flats	Box Butte	Niobrara	do	31,300	87	5,508	1,422,000	1946
Frenchman-Cambridge (Missouri River Basin).	Medicine Creek	Medicine Creek	do	93,000	180	5,630	2,883,000	(4)
	Trenton	Republican	do	172,000	95	7,800	(6)	(4)
Nebraska-Wyoming:								
North Platte	Guernsey	North Platte	Earth, power plant	48,100	135	560	586,200	1927
	Lake Alice, upper	Offstream	Earth	11,400	30	3,100	240,600	1913
	Lake Alice, lower	do	do		23	2,550	119,000	1912
	Minatare	do	do	[2] 60,800	63	3,700	696,100	1915
	Pathfinder	North Platte	Masonry arch-gravity	[2] 1,070,000	214	1,070	65,700	1909
	Pathfinder dike	do	Earth		38	1,650	152,200	1909
Nevada:								
Humboldt	Rye Patch	Humboldt	do	[2] 179,000	80	914	356,300	1936
Newlands	Lahontan	Garson	Earth, power plant	[2] 273,600	162	5,400	733,100	1915
	Lake Tahoe [1]	Truckee	Concrete slab-and-buttress, lake outlet regulator.	[2] 732,000	16	109	430	1913
Nevada-California:								
Truckee River storage	Boca	Little Truckee	Earth	41,200	116	1,629	911,900	1939
New Mexico:								
Carlsbad	Alamogordo	Pecos	Earth and rockfill	156,800	148	3,084	1,914,900	1937
	Avalon [1]	do	Earth	7,000	58	1,025	202,300	1891
	McMillan	do	do	38,700	57	2,114	234,000	1894

See footnotes at end of table.

TABLE 6.—*Bureau of Reclamation dams*—Continued

State and project	Name of dam	River	Type	Capacity	Height	Length	Volume	Year
New Mexico-Texas:								
Rio Grande	Caballo [1]	Rio Grande	Earth	345, 900	112	4, 558	1, 244, 200	1938
	Elephant Butte	do	Concrete gravity, power plant (1940).	[2] 2, 219, 000	301	1, 674	629, 500	1916
North Dakota:								
Heart Butte (Missouri River Basin).	Heart Butte	Heart River	Earth	450, 000	174	1, 850	1, 222, 000	(4)
Dickinson (Missouri River Basin).	Dickinson	do	do	16, 500	69	2, 225	326, 000	(4)
Oklahoma:								
W. C. Austin	Altus [1]	Red, North Fork	Concrete gravity, masonry-faced.	[2] 151, 700	110	1, 112	70, 200	1945
Oregon:								
Baker	Thief Valley	Powder	Concrete slab-and-buttress	17, 400	70	390	6, 288	1932
Burnt River	Unity	Burnt	Earth, rock-faced	25, 800	83	675	253, 600	1938
Deschutes	Crane Prairie	Deschutes	Earth	55, 300	36	285	29, 700	1940
	Wickiup	do	do	180, 000	100	13, 860	1, 852, 000	1949
	Wickiup-East Dike	do	do		28	3, 420		1949
Umatilla	Cold Springs	Offstream	do	[2] 50, 000	117	3, 450	793, 400	1908
	McKay	McKay Creek	Earth, concrete-faced	[2] 73, 800	180	2, 700	2, 363, 800	1927
Vale	Agency Valley	Malheur, North Fork	Earth	59, 900	110	1, 850	645, 300	1935
	Warm Springs	Malheur, Middle Fork	Concrete arch	192, 400	106	469	19, 500	1919
Oregon-California:								
Klamath	Clear Lake	Lost	Earth	527, 000	39	840	63, 400	1910
	Gerber	Miller Creek	Concrete arch	[2] 94, 300	88	485	11, 900	1925
	Link River	Link	Concrete slab-and-buttress, lake outlet regulator.	[2] 873, 000	22	435	2, 200	1921
Oregon-Idaho:								
Owyhee	Owyhee [1]	Owyhee	Concrete arch-gravity	1, 120, 000	417	833	537, 500	1932
South Dakota:								
Angostura (Missouri River Basin).	Angostura	Cheyenne	Concrete gravity, embankment wing.	220, 000	187	1, 900	749, 600	(4)
Belle Fourche	Belle Fourche	Owl Creek	Earth, concrete-faced	[2] 177, 500	122	6, 262	1, 783, 200	1911
Rapid Valley	Deerfield	Castle Creek	Earth	15, 700	133	825	607, 400	1947
Shadehill (Missouri River Basin).	Shadehill	Grand	do	467, 000	145	1, 900	3, 500, 000	(4)
Texas:								
Colorado River	Marshall Ford	Colorado (Texas)	Concrete gravity, embankment wings, power plant.	1, 951, 300	278	5, 093	3, 579, 000	1942
Utah:								
Hyrum	Hyrum [1]	Little Bear	Earth	18, 800	116	540	435, 600	1935
Moon Lake	Midview	Offstream	do	5, 800	4	663	138, 900	1937
	Moon Lake	Lake Fork, West Fork	do	[2] 35, 800	110	1, 108	513, 100	1938
Newton	Newton	Clarkson Creek	do	5, 500	101	4, 781	410, 000	1946
Ogden River	Pine View	Ogden	do	43, 600	103	480	267, 700	1937
Provo River	Deer Creek	Provo	do	152, 600	235	1, 304	2, 827, 900	1941

Scofield Dam	Scofield	Price	do	73,000	125	575	202,700	1946
Strawberry Valley	Strawberry	Strawberry	do	283,000	79	488	117,900	1913
Weber River	Echo	Weber	do	73,900	158	1,887	1,539,800	1931
Washington:								
Columbia Basin	Grand Coulee	Columbia	Concrete gravity, 2 power plants and pumping plant.	9,517,000	550	4,173	10,585,000	1942
	South Coulee	Offstream	Earth	1,484,000	94	9,800	1,605,000	(4)
	North Coulee	do	do		145	1,400	1,228,000	(4)
	Long Lake	do	do	62,700	130	1,900	1,489,000	1948
	O'Sullivan	Lower Crab Creek	do	606,000	200	19,000	9,245,000	(4)
Okanogan	Conconully	Salmon Creek	Earth, hydraulic fill	[2] 13,000	70	1,000	359,000	1910
	Salmon Lake	do	Earth	[2] 10,500	42	1,260	194,900	1921
Yakima	Bumping Lake	Bumping	do	37,300	45	3,660	252,600	1910
	Clear Creek	Tieton, North Fork	Concrete arch	5,300	80	404	5,800	1914
	Cle Elum	Cle Elum	Earth	529,200	135	750	1,411,300	1933
	Kachess	Kachess	do	[2] 239,000	114	1,400	199,600	1912
	Keechelus	Yakima	do	170,500	103	6,550	683,500	1917
	Tieton	Tieton	Earth, semihydraulic fill	[2] 197,000	235	920	2,048,600	1925
Wyoming:								
Boysen (Missouri River Basin)	Boysen	Big Horn	Earth, power plant	1,493,000	220	1,000	1,689,000	(4)
Kendrick	Alcova [1]	North Platte	Earth	190,700	265	763	1,635,300	1938
	Seminoe	do	Concrete arch, power plant	[2] 1,026,000	295	530	210,200	1939
Kortes Power (Missouri River Basin).	Kortes [3]	do	Concrete gravity, power plant	4,800	240	440	147,000	(4)
Riverton	Bull Lake	Bull Lake Creek	Earth	[2] 152,000	81	3,456	819,600	1938
	Pilot Butte	Offstream	Earth, semihydraulic fill	[2] 31,600	51	1,300	135,300	1926
Wyoming-Montana:								
Shoshone	Deaver	do	Earth	680	14	1,300	30,300	1918
	Ralston	do	do	1,500	35	2,200	24,700	1908
	Buffalo Bill	Shoshone	Concrete arch, power plant	[2] 456,600	325	200	82,900	1910

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[1] Storage and diversion—dam classified according to its principal feature.

[2] Live storage—dead storage not evaluated.

[3] Power dam—water supply for generation of power.

[4] Under construction.

[5] Horsetooth Reservoir formed by 4 dams.

[6] Not available.

NOTES

Capacity: Storage dams—acre-feet of reservoir storage provided by highest controlled water surface; diversion dams—second-feet of diversion provided by canal headworks at dam.

Height: Storage dams—feet between lowest point in foundation and normal crest of dam; diversion dams—feet between original streambed and highest controlled water surface.

Length: Feet of barrier in dam and integral features constructed between natural abutments.

Volume: Cubic yards of all material in dam and its appurtenant features.

Year: Date original construction was completed. (Tabular data include supplemental construction.)

TABLE 7.—*Projects in operation—irrigation and crop value data for the calendar year 1948*

State, project, and subdivisions	Projects entirely constructed by the Bureau							Projects furnished supplemental storage water from works constructed by the Bureau					Special and Warren Act contractors receiving water from Bureau-constructed works				
	Irrigable area [1]	Irrigated area	Land subject to construction charges			Temporarily suspended lands [2]											
			Net area in cultivation	Crop values		Net area in cultivation	Total crop values	Irrigable area [1]	Irrigated area	Net area in cultivation	Crop values		Irrigable area	Irrigated area	Net area in cultivation	Crop values	
				Total	Per acre						Total	Per acre				Total	Per acre
REGION 1																	
Idaho																	
Boise:																	
	Acres	*Acres*	*Acres*			*Acres*		*Acres*	*Acres*	*Acres*			*Acres*	*Acres*	*Acres*		
Big Bend irrigation district (Oregon)	1,712	1,394	1,394	$97,016	$69.60	0	0										
Black Canyon irrigation district (Notus)	6,872	6,599	6,599	874,189	132.47	0	0										
Black Canyon irrigation district (Payette)	29,405	25,372	25,818	1,775,889	68.78	0	0										
Boise-Kuna irrigation district	48,488	44,942	45,079	4,401,487	97.64	0	0										
Nampa-Meridian irrigation district	40,262	34,287	34,367	3,081,235	89.66	0	0										
New York irrigation district	17,826	14,583	14,634	791,344	54.08	0	0										
Settlers irrigation district	518																
Wilder irrigation district	56,538	50,191	50,196	6,349,149	126.49	33	$2,760										
Total—Boise project	201,621	177,368	178,087	17,370,309	97.54	33	2,760						125,303	116,900	116,900	$13,369,652	$114.37
Minidoka:																	
American Falls Reservoir District No. 2	90,282	84,724	84,724	5,731,037	67.64												
Burley irrigation district	47,937	44,438	44,438	4,509,746	101.48												
Fremont-Madison irrigation district								112,000	102,625	103,825	$6,944,757	$66.89					
Minidoka irrigation district	71,882	62,509	62,509	6,035,323	96.55												
Total—Minidoka project	210,101	191,671	191,671	16,276,106	84.92			112,000	102,625	103,825	6,994,757	66.89	714,814	675,963	675,341	60,293,000	89.28
Rathdrum Prairie-Post Falls unit [3]								3,109	2,183	2,183	136,620	62.58					
Montana																	
Bitter Root [4]	16,665	16,177	16,442	602,792	36.66												
Frenchtown	4,935	1,894	2,664	112,755	42.33												

Oregon																	
Baker								7,312	7,255	7,255	279,600	38.54					
Burnt River								15,291	15,260	15,260	511,052	33.49					
Deschutes (Central Oregon irrigation district)								44,218	42,350	42,350	4,622,136	109.14					
Deschutes (north unit)	43,732	26,715	27,535	3,009,205	109.29												
Stanfield								6,000	5,073	5,073	267,787	52.79					
Umatilla:																	
East division	10,911	8,179	8,179	327,895	40.09												
West division	7,620	5,001	5,276	220,095	41.72												
Total—Umatilla project	18,531	13,180	13,455	547,990	40.73								1,025	878	916	78,696	85.91
Vale	32,000	31,550	31,550	2,712,606	85.98												
Westland								8,055	4,819	4,819	243,126	50.45					
Oregon-Idaho																	
Owyhee:																	
Advancement irrigation district	701	603	603	60,895	100.99	0	0										
Bench irrigation district	2,311	2,205	2,205	432,448	196.12	0	0										
Crystal irrigation district	1,263	1,137	1,137	217,743	191.51	0	0										
Gem irrigation district (Idaho)	31,287	27,330	26,491	2,979,496	112.47	839	54,974										
Ontario-Nyssa irrigation district	5,863	5,357	5,357	863,751	161.24	0	0										
Owyhee irrigation district	56,199	50,119	50,299	5,359,588	106.55	0	0										
Payette-Oregon Slope irrigation district	4,617	4,139	4,139	957,631	231.37	0	0										
Slide irrigation district	1,092	1,072	1,072	160,487	149.71	0	0										
Total—Owyhee project	103,333	91,962	91,303	11,032,039	120.83	839	54,974						13,800	13,130	13,130	2,177,936	165.87
Washington																	
Columbia Basin	5,743	232	235	18,740	79.74												
Okanogan	5,346	3,733	3,850	1,533,518	398.32												
Yakima:																	
Kittitas division	69,552	54,325	54,821	3,615,536	65.95	97	776										
Roza division	44,570	37,461	37,329	7.559,677	202.51	121	8,132										
Sunnyside division	103,579	83,469	83,698	13,146,662	157.07	381	24,757										
Tieton division	27,276	24,546	24,689	9,137,330	370.10	0	0										
Total—Yakima project	244,977	199,801	200,537	33,459,205	166.85	599	33,665						191,440	164,307	162,873	26,842,468	164.81
Total—Region 1	886,984	754,283	757,329	86,675,265	114.45	1,471	19,399	195,985	179,565	180,765	13,005,078	71.94	1,046,382	971,178	969,160	102,761,752	106.03

See footnotes at end of table.

TABLE 7.—*Projects in operation—irrigation and crop value data for the calendar year 1948*—Continued

State, project, and subdivisions	Projects entirely constructed by the Bureau							Projects furnished supplemental storage water from works constructed by the Bureau					Special and Warren Act contractors receiving water from Bureau-constructed works				
	Irrigable area [1]	Irrigated area	Land subject to construction charges			Temporarily suspended lands [2]		Irrigable area [1]	Irrigated area	Net area in cultivation	Crop values		Irrigable area	Irrigated area	Net area in cultivation	Crop values	
			Net area in cultivation	Crop values		Net area in cultivation	Total crop values				Total	Per acre				Total	Per acre
				Total	Per acre												
REGION 2																	
California																	
	Acres	*Acres*	*Acres*			*Acres*		*Acres*	*Acres*	*Acres*			*Acres*	*Acres*	*Acres*		
Central Valley [5]													219, 087	186, 197	203, 351	$31, 196,273	$153. 41
Orland	19, 495	16, 566	16, 566	$1, 412, 077	$85. 24												
Oregon-California																	
Klamath:																	
Main division (Oregon)	40, 998	33, 201	32, 182	4, 028, 203	125. 17	1, 114	$39, 324										
Tule Lake division (California)	36, 619	35, 442	35, 379	4, 357, 251	123. 16	83	6, 898										
Total—Klamath project	77, 617	68, 643	67, 561	8, 385, 454	124. 12	1, 197	46, 222						84, 948	75, 845	75, 845	6, 343, 332	83. 64
Total—Region 2	97, 112	85, 209	84, 127	9, 797, 531	116. 46	1, 197	46, 222						304, 035	262, 042	279, 196	37, 539, 605	134. 46
REGION 3																	
Arizona																	
Gila:																	
Yuma Mesa	20, 105	6, 108	6, 488	529, 317	81. 58												
North Gila Valley	5, 676	5, 676	5, 676	1, 156, 081	203. 68												
Total—Gila project	25, 781	11, 784	12, 164	1, 685, 398	138. 56								6, 239	4, 652	4, 652	417, 647	89. 78
Salt River	243, 125	216, 035	224, 635	33, 079, 859	147. 26								97, 444	85, 192	84, 253	11, 823, 574	140. 33
Arizona-California																	
Yuma:																	
Bard division (California)	6, 890	5, 280	5, 280	682, 314	129. 23	0	0										
Reservation division (California)	7, 743	2, 656	2, 656	313, 366	117. 98	0	0										
Valley division (Arizona)	50, 390	46, 526	46, 265	13, 971, 371	301. 99	261	21, 788										
Yuma Auxiliary (Mesa) (Arizona)	3, 925	2, 059	2, 059	334, 964	162. 68	0	0										

California																	
All-American Canal: Imperial irrigation district													$523,000	413,381	433,381	90,801,735	209.52
Total—Region 3	337,854	284,340	293,059	50,067,272	170.84	261	21,788						626,683	503,225	522,286	103,042,956	197.29
REGION 4																	
Colorado																	
Fruitgrowers Dam								2,662	2,165	2,165	180,685	$83.46					
Grand Valley:																	
Gravity division	30,444	20,493	20,493	1,372,087	66.95												
Orchard Mesa irrigation district [4]	10,027	8,763	8,763	1,409,930	160.90												
Total—Grand Valley project	40,471	29,256	29,256	2,782,017	95.09								7,950	7,679	7,679	847,952	110.42
Pine River								34,206	32,226	32,626	751,031	23.02					
Uncompahgre	92,190	66,593	64,324	3,633,312	56.48	2,269	73,327						5,889	5,537	5,537	253,798	45.84
Nevada																	
Humboldt								39,131	25,085	25,085	1,639,010	65.34					
Newlands	69,472	53,894	52,591	3,192,011	60.70	1,303	24,666										
Truckee River Storage								28,811	24,725	24,725	1,849,477	74.80					
Utah																	
Hyrum								6,261	5,113	5,278	296,988	56.27					
Moon Lake								72,608	53,037	54,864	922,015	16.81					
Newton [3]								2,295	2,035	2,105	129,143	61.35					
Ogden River								22,125	15,384	15,384	1,435,494	93.31					
Provo River—Deer Creek division								46,365	39,297	39,603	4,864,501	122.83					
Sanpete:																	
Ephraim division								6,700	5,880	6,159	143,396	23.28					
Spring City division								6,017	4,857	5,207	149,539	28.72					
Total—Sanpete project								12,717	10,737	11,366	292,935	25.77					
Scofield [3]						1,000	10,000	15,609	14,544	14,009	419,651	29.96					
Strawberry Valley:																	
Highline division	18,404	16,124	16,719	764,120	45.70												
Spanish Fork division	13,792	13,078	13,205	746,134	56.50												
Springville-Mapleton irrigation district	9,994	9,221	9,264	605,000	65.31												
Total—Strawberry Valley project	42,190	38,423	39,188	2,115,254	53.98								6,174	5,851	5,908	334,035	56.54
Weber River (Salt Lake Basin)								91,727	90,377	90,577	10,682,867	117.94					
Total—Region 4	244,323	188,166	185,359	11,722,594	63.24	4,572	107,993	374,517	314,725	317,78	723,463,797	73.84	20,013	19,067	19,124	1,435,785	75.08

See footnotes at end of table.

TABLE 7.—*Projects in operation—irrigation and crop value data for the calendar year 1948*—Continued

State, project, and subdivisions	Projects entirely constructed by the Bureau							Projects furnished supplemental storage water from works constructed by the Bureau					Special and Warren Act contractors receiving water from Bureau-constructed works				
	Irrigable area [1]	Irrigated area	Land subject to construction charges			Temporarily suspended lands [2]		Irrigable area [1]	Irrigated area	Net area in cultivation	Crop values		Irrigable area	Irrigated area	Net area in cultivation	Crop values	
			Net area in cultivation	Crop values		Net area in cultivation	Total crop values				Total	Per acre				Total	Per acre
				Total	Per acre												
REGION 5																	
Oklahoma																	
	Acres	*Acres*	*Acres*			*Acres*		*Acres*	*Acres*	*Acres*			*Acres*	*Acres*	*Acres*		
W. C. Austin	30, 558	17, 433	17, 433	$1, 558, 691	$89. 41												
New Mexico																	
Carlsbad	25, 055	20, 167	20, 167	2, 727, 119	135. 23												
Tucumcari	25, 024	16, 069	16, 069	777, 572	48. 39												
New Mexico-Texas																	
Rio Grande:																	
Elephant Butte irrigation district (New Mexico)	88, 000	89, 161	89, 650	23, 090, 166	257. 56												
El Paso County water improvement district No. 1 (Texas)	67, 000	66, 554	66, 799	19, 729, 890	295. 36												
Total, Rio Grande project [6]	155, 000	155, 715	156, 449	42, 820, 056	273. 70								20, 301	17, 153	17, 153	$3, 997, 381	$233. 04
Texas																	
Balmorhea [3]								10, 550	7, 144	7, 144	$682, 704	$95. 56					
Total, Region 5	235, 637	209, 384	210, 118	47, 883, 438	227. 89			10, 550	7, 144	7, 144	682, 704	95. 56	20, 301	17, 153	17, 153	3, 997, 381	233. 04
REGION 6																	
Montana																	
Buffalo Rapids:																	
First division	14, 826	14, 248	14, 248	781, 545	54. 85												
Second division	8, 100	6, 621	6, 924	118, 905	17. 17												
Total, Buffalo Rapids project [3]	22, 926	20, 869	21, 172	900, 450	42. 53												

Dodson pumping unit (Milk River) [3]	935	935	935	49, 020	52. 43	------	------	------	------	------	------	------	------	------	------	------	------
Huntley	32, 508	24, 350	16, 896	1, 100, 492	65. 13	7, 798	244, 622	------	------	------	------	------	------	------	------	------	------
Intake [3]	881	349	349	14, 371	41. 18	------	------	------	------	------	------	------	------	------	------	------	------
Milk River:																	
Chinook division	43, 484	32, 448	32, 448	1, 468, 163	45. 25	0	0	------	------	------	------	------	------	------	------	------	------
Glasgow division	19, 407	9, 155	12, 090	381, 019	31. 52	633	15, 654	------	------	------	------	------	------	------	------	------	------
Malta division	53, 733	24, 491	15, 305	649, 222	42. 42	9, 979	136, 326	------	------	------	------	------	------	------	------	------	------
Pump lands	5, 871	5, 871	5, 871	385, 833	65. 72	0	0	------	------	------	------	------	------	------	------	------	------
Total, Milk River project	122, 495	71, 965	65, 714	2, 884, 237	43. 89	10, 612	151, 980	------	------	------	------	------	------	------	------	------	------
Sun River:																	
Fort Shaw division	13, 902	7, 705	8, 283	224, 123	27. 06	81	1, 967	------	------	------	------	------	------	------	------	------	------
Greenfields division	83, 164	46, 331	76, 791	2, 615, 880	34. 06	0	0	------	------	------	------	------	------	------	------	------	------
Total, Sun River project	97, 066	54, 036	85, 074	2, 840, 003	33. 38	81	1, 967	------	------	------	------	------	------	------	------	------	------
Montana-North Dakota																	
Lower Yellowstone:																	
District No. 1 (Montana)	37, 272	32, 612	32, 612	1, 822, 077	55. 87	------	------	------	------	------	------	------	------	------	------	------	------
District No. 2 (North Dakota)	19, 928	16, 297	16, 297	943, 230	57. 88	------	------	------	------	------	------	------	------	------	------	------	------
Total, Lower Yellowstone project	57, 200	48, 909	48, 909	2, 765, 307	56. 54	------	------	------	------	------	------	------	------	------	------	------	------
North Dakota																	
Buford-Trenton [3]	7, 915	7, 216	7, 751	296, 951	38. 31	------	------	------	------	------	------	------	------	------	------	------	------
South Dakota																	
Belle Fourche	72, 431	39, 272	57, 188	2, 031, 537	35. 52	------	------	------	------	------	------	------	------	------	------	------	------
Rapid Valley [3]	------	------	------	------	------	------	------	10, 735	9, 342	15, 342	279, 887	18. 24	------	------	------	------	------
Wyoming																	
Riverton	47, 407	41, 661	42, 730	1, 851, 883	43. 34	------	------	------	------	------	------	------	1, 512	1, 512	1, 512	67, 158	44. 42
Shoshone:																	
Frannie division	20, 041	11, 736	10, 985	398, 277	36. 26	751	25, 001	------	------	------	------	------	------	------	------	------	------
Garland division	41, 627	34, 061	33, 039	2, 101, 870	63. 62	1, 022	17, 315	------	------	------	------	------	------	------	------	------	------
Heart Mountain division	13, 947	6, 788	6, 788	252, 340	37. 17	0	0	------	------	------	------	------	------	------	------	------	------
Willwood division	11, 542	10, 497	10, 497	674, 746	64. 28	0	0	------	------	------	------	------	------	------	------	------	------
Total, Shoshone project	87, 157	63, 082	61, 309	3, 427, 233	55. 90	1, 773	42, 316	------	------	------	------	------	------	------	------	------	------
Total, Region 6	548, 921	372, 644	408, 027	18, 161, 484	44. 51	20, 264	440, 885	10, 735	9, 342	15, 342	279, 887	18. 24	1, 512	1, 512	1, 512	67, 158	44. 42

See footnotes at end of table.

TABLE 7.—*Projects in operation—irrigation and crop value data for the calendar year 1948*—Continued

State, project, and subdivisions	Projects entirely constructed by the Bureau							Projects furnished supplemental storage water from works constructed by the Bureau					Special and Warren Act contractors receiving water from Bureau-constructed works				
	Irrigable area [1]	Irrigated area	Land subject to construction charges			Temporarily suspended lands [2]											
			Net area in cultivation	Crop values		Net area in cultivation	Total crop values	Irrigable area [1]	Irrigated area	Net area in cultivation	Crop values		Irrigable area	Irrigated area	Net area in cultivation	Crop values	
				Total	Per acre						Total	Per acre				Total	Per acre
REGION 7	*Acres*	*Acres*	*Acres*			*Acres*		*Acres*	*Acres*	*Acres*			*Acres*	*Acres*	*Acres*		
Nebraska																	
Mirage Flats [3]	11, 604	10, 169	10, 169	$416, 611	$40. 97												
Nebraska-Wyoming																	
North Platte:																	
Gering and Fort Laramie irrigation district	54, 845	51, 873	50, 501	2, 790, 917	55. 26	1, 421	22, 576										
Goshen irrigation district, Wyoming	52, 486	44, 968	42, 506	2, 764, 740	65. 04	2, 795	21, 520										
Northport irrigation district	16, 170	10, 853	9, 374	554, 114	59. 11	1, 479	24, 867										
Pathfinder irrigation district	112, 943	92, 689	74, 871	4, 798, 479	64. 09	17, 818	301, 950										
Total, North Platte project	236, 444	200, 383	177, 252	10, 908, 250	61. 54	23, 513	370, 913						139, 625	119, 959	130, 810	$8, 618, 030	$65. 88
Wyoming																	
Kendrick	7, 723	3, 824	2, 699	45, 611	16. 90	1, 125	36, 209										
Total, Region 7	255, 771	214, 376	190, 120	11, 370, 472	59. 81	24, 638	407, 122						139, 625	119, 959	130, 810	8, 618, 030	65. 88

Summary	Projects entirely constructed by the Bureau						
	Irrigable area [1]	Irrigated area	Land subject to construction charges			Temporarily suspended lands [2]	
			Net area in cultivation	Crop values		Net area in cultivation	Total crop values
				Total	Per acre		
Region 1	886, 984	754, 283	757, 329	$86, 675, 265	$114. 45	1, 471	$91, 399
Region 2	97, 112	85, 209	84, 127	9, 797, 531	116. 46	1, 197	46, 222
Region 3	337, 854	284, 340	293, 059	50, 067, 272	170. 84	261	21, 788
Region 4	244, 323	188, 166	185, 359	11, 722, 594	63. 24	4, 572	107, 993
Region 5	235, 637	209, 384	210, 118	47, 883, 438	227. 89	0	0
Region 6	548, 921	372, 644	408, 027	18, 161, 484	44. 51	20, 264	440, 885
Region 7	255, 771	214, 376	190, 120	11, 370, 472	59. 81	24, 638	407, 122
Total	2, 606, 602	2, 108, 402	2, 128, 139	235, 678, 056	110. 74	52, 403	1, 115, 409

Summary	Projects furnished supplemental storage water from works constructed by the Bureau					Special and Warren Act contractors receiving water from Bureau constructed works				
	Irrigable area [1]	Irrigated area	Net area in cultivation	Crop values		Irrigable area	Irrigated area	Net area in cultivation	Crop values	
				Total	Per acre				Total	Per acre
Region 1	195, 985	179, 565	180, 765	$13, 005, 078	$71. 94	1, 046, 382	971, 178	969, 160	$102, 761, 752	$106. 03
Region 2	0	0	0	0	0	304, 035	262, 042	279, 196	37, 539, 605	134. 46
Region 3	0	0	0	0	0	626, 683	503, 225	522, 286	103, 042, 956	197. 29
Region 4	374, 517	314, 725	317, 787	23, 463, 797	73. 84	20, 013	19, 067	19, 124	1, 435, 785	75. 08
Region 5	10, 550	7, 144	7, 144	682, 704	95. 56	20, 301	17, 153	17, 153	3, 997, 381	233. 04
Region 6	10, 735	9, 342	15, 342	279, 887	18. 24	1, 512	1, 512	1, 512	67, 158	44. 42
Region 7	0	0	0	0	0	139, 625	119, 959	130, 810	8, 618, 030	65. 88
Total	591, 787	510, 776	521, 038	37, 431, 466	71. 76	2, 158, 551	1, 894, 136	1, 939, 241	257, 462, 667	132. 76

See footnotes at end of table.

TABLE 7.—*Projects in operation—irrigation and crop value data for the calendar year 1948*—Continued

Summary	Projects entirely constructed by the Bureau				
	Irrigable area [1]	Irrigated area	Land subject to construction charges		
			Net area in cultivation	Crop values	
				Total	Per acre
Totals—regular projects	2, 606, 602	2, 108, 402	2, 128, 139	$235, 678, 056	$110. 74
Totals—storage projects	591, 787	510, 776	521, 038	37, 431, 466	71. 76
Totals—special and Warren Act contractors	2, 158, 551	1, 894, 136	1, 939, 241	257, 462, 667	132. 76
Additional areas reported:					
Temporarily suspended			52, 403	1, 115, 409	21. 29
Leased areas		45, 441	58, 913	2, 935, 943	49. 84
Total	5, 356, 940	4, 558, 755	4, 699, 734	534, 623, 541	113. 76
Additional irrigable lands, no crop details reported [7]	23, 075				
Grand total	5, 380, 015	4, 558, 755	4, 699, 734	534, 623, 541	113. 76
Grand total, 1947	5, 166, 783	4, 461, 702	4, 554, 352	555, 420, 804	121. 95
Increase and decrease, 1947–48 totals	+213, 232	+97, 053	+145, 382	−20, 797, 263	−8. 19

[1] Area for which the Bureau is prepared to supply water.

[2] Generally part of irrigable area but not subject to construction charges until reclaimed.

[3] Water conservation and utilization project.

[4] Private project reconstructed with Government funds.

[5] Includes 61,268 acres, producing crops valued at $6,599,148, outside the permanent project service area, furnished water from project facilities under interim contracts.

[6] Although there are 177,962 acres that can be irrigated within project limits, the area for which there is considered to be a safe and reliable water supply is 155,000 acres.

[7] Includes Arnold and Lone Pine irrigation districts, Deschutes project; and Indian reservation lands on Pine River project.

NOTE.—Per acre value based on net area in cultivation.

Year	Federal irrigation projects [1]				Warren Act lands and special contractors				Entire area			
	Irrigated acreage	Net area in cultivation	Total crop value		Irrigated acreage	Net area in cultivation	Total crop value		Irrigated acreage	Net area in cultivation	Total crop value	
			For year	Cumulative total			For year	Cumulative total			For year	Cumulative total
1906	22, 300	[2] 20, 100	$244, 900						22, 300	[2] 20, 100	$244, 900	
1907	187, 628	[2] 169, 000	4, 760, 460	$5, 005, 360					187, 628	[2] 169, 000	4, 760, 460	$5, 005, 360
1908	289, 549	[2] 260, 500	7, 635, 888	12, 641, 248					289, 549	[2] 260, 500	7, 635, 888	12, 641, 248
1909	410, 628	[2] 369, 500	11, 920, 663	24, 561, 911					410, 628	[2] 369, 500	11, 920, 663	24, 561, 911
1910	471, 423	413, 000	12, 944, 639	37, 506, 550					471, 423	413, 000	12, 944, 639	37, 506, 550
1911	562, 311	470, 100	13, 086, 441	50, 592, 991					562, 311	470, 100	13, 086, 441	50, 592, 991
1912	614, 477	540, 000	16, 007, 134	66, 600, 125					614, 477	540, 000	16, 007, 134	66, 600, 125
1913	694, 142	637, 227	15, 676, 409	82, 276, 534					694, 142	637, 227	15, 676, 409	82, 276, 534
1914	761, 271	703, 424	16, 475, 517	98, 752, 051					761, 271	703, 424	16, 475, 517	98, 752, 051
1915	810, 649	760, 035	18, 164, 452	116, 916, 503					810, 649	760, 035	18, 164, 452	116, 916, 503
1916	922, 821	858, 291	32, 815, 972	149, 732, 475					922, 821	858, 291	32, 815, 972	149, 732, 475
1917	1, 026, 663	966, 784	56, 462, 313	206, 194, 788					1, 026, 663	966, 784	56, 462, 313	206, 194, 788
1918	1, 119, 566	1, 051, 193	66, 821, 396	273, 016, 184	[2] 501, 100	[2] 481, 600	$35, 000, 000		[2] 1, 620, 666	1, 532, 793	101, 821, 396	308, 016, 184
1919	1, 187, 255	1, 113, 469	88, 974, 137	361, 990, 321	916, 313	880, 613	64, 368, 468	$99, 368, 468	2, 103, 568	1, 994, 082	153, 342, 665	461, 358, 789
1920	1, 223, 480	1, 153, 820	66, 171, 650	428, 161, 971	981, 940	950, 890	47, 836, 750	147, 205, 218	2, 205, 420	2, 104, 710	114, 008, 400	575. 367, 189
1921	1, 227, 500	1, 157, 900	49, 620, 300	477, 782, 271	1, 001, 250	969, 550	45, 288, 630	192, 493, 848	2, 228, 750	2, 127, 450	94, 908, 930	670, 276, 119
1922	1, 202, 130	1, 169, 100	50, 360, 850	528, 143, 121	983, 290	951, 270	33, 240, 840	225, 734, 688	2, 185, 420	2, 120, 370	83, 601, 690	753, 877, 809
1923	1, 213, 700	1, 179, 870	65, 046, 300	593, 189, 421	1, 051, 380	993, 040	37, 557, 860	263, 292, 548	2, 265, 080	2, 172, 910	102, 604, 160	856, 481, 969
1924	1, 290, 890	1, 216, 610	66, 488, 560	659, 677, 981	930, 670	889, 460	43, 237, 470	306, 530, 018	2, 221, 560	2, 106, 070	109, 726, 030	966, 207, 999
1925	1, 320, 300	1, 242, 750	77, 608, 880	737, 286, 861	1, 019, 170	951, 250	53, 655, 850	360, 185, 868	2, 339, 470	2, 194, 000	131, 264, 730	1, 097, 472, 729
1926	1, 411, 020	1, 328, 810	60, 369, 620	797, 656, 481	1, 097, 190	949, 590	49, 750, 040	409, 935, 908	2, 508, 210	2, 278, 400	110, 119, 660	1, 207, 592, 389
1927	1, 378, 990	1, 326, 810	70, 985, 450	868, 641, 931	1, 148, 115	1, 072, 486	61, 160, 010	471, 095, 918	2, 527, 105	2, 399, 296	132, 145, 460	1, 339, 737, 849
1928	1, 442, 080	1, 385, 560	80, 238, 800	948, 880, 731	1, 235, 020	1, 192, 030	62, 495, 320	533, 591, 238	2, 677, 100	2, 577, 590	142, 734, 120	1, 482, 471, 969
1929	1, 483, 900	1, 420, 070	87, 559, 670	1, 036, 440, 401	1, 234, 230	1, 192, 990	72, 720, 490	606, 311, 728	2, 718, 130	2, 613, 060	160, 280, 160	1, 642, 752, 129
1930	1, 504, 810	1, 467, 097	64, 418, 940	1, 100, 859, 341	1, 286, 046	1, 254, 493	54, 654, 550	660, 966, 278	2, 790, 856	2, 721, 590	119, 073, 490	1, 761, 825, 619
1931	1, 522, 718	1, 462, 565	40, 121, 089	1, 140, 980, 430	1, 293, 889	1, 251, 830	33, 406, 340	694, 372, 618	2, 816, 607	2, 714, 395	73, 527, 429	1, 835, 353, 048
1932	1, 555, 144	1, 506, 320	31, 165, 752	1, 172, 146, 182	1, 214, 461	1, 196, 400	18, 627, 219	712, 999, 837	2, 769, 605	2, 702, 720	49, 792, 971	1, 885, 146, 019
1933	1, 589, 770	1, 529, 903	48, 138, 576	1, 220, 284, 758	1, 239, 017	1, 199, 113	35, 425, 870	748, 425, 707	2, 828, 787	2, 729, 016	83, 564, 446	1, 968, 710, 465
1934	1, 552, 124	1, 464, 405	59, 628, 327	1, 279, 913, 085	1, 285, 081	1, 229, 594	40, 160, 676	788, 586, 383	2, 837, 205	2, 693, 999	99, 789, 003	2, 068, 499, 468
1935	1, 640, 936	1, 604, 166	63, 601, 663	1, 343, 514, 748	1, 294, 680	1, 256, 970	43, 179, 631	831, 766, 014	2, 935, 616	2, 861, 136	106, 781, 294	2, 175, 280, 762
1936	1, 702, 192	1, 629, 174	78, 902, 818	1, 422, 417, 566	1, 335, 995	1, 272, 745	57, 599, 662	889, 365, 676	3, 038, 187	2, 901, 919	136, 502, 480	2, 311, 783, 242
1937	1, 725, 463	1, 700, 969	72, 893, 649	1, 495, 311, 215	1, 389, 338	1, 333, 800	45, 764, 623	935, 130, 299	3, 114, 801	3, 034, 769	118, 658, 272	2, 430, 441, 514
1938	1, 777, 584	1, 764, 363	67, 859, 804	1, 563, 171, 019	1, 329, 115	1, 276, 332	45, 603, 656	980, 733, 955	3, 106, 699	3, 040, 695	113, 463, 460	2, 543, 904, 974
1939	1, 922, 868	1, 903, 269	73, 769, 654	1, 636, 940, 673	1, 218, 108	1, 174, 803	40, 313, 140	1, 021, 047, 095	3, 140, 976	3, 078, 072	114, 082, 794	2, 657, 987, 768
1940	2, 152, 808	2, 138, 927	80, 098, 196	1, 717, 038, 869	1, 238, 262	1, 177, 103	37, 690, 481	1, 058, 737, 576	3, 391, 070	3, 316, 030	117, 788, 677	2, 775, 776, 445
1941	2, 199, 179	2. 178, 288	110, 399, 806	1, 827, 438, 675	1, 140, 204	1, 202, 172	49, 486, 191	1, 108, 223, 767	3, 339, 383	3, 380, 460	159, 885, 997	2, 935, 662, 442
1942	2, 277, 955	2, 259, 653	155, 619, 716	1, 983, 058, 391	1, 602, 907	1, 562, 046	116, 428, 800	1, 224, 652, 567	3, 880, 862	3, 821, 699	272, 048, 516	3, 207, 710, 958
1943	2, 422, 288	2, 398, 922	218, 064, 208	2, 201, 122, 599	1, 633, 041	1, 615, 424	170, 606, 761	1, 395, 259, 328	4, 055, 329	4, 014, 346	388, 670, 969	3, 596, 381, 927
1944	2, 468, 842	2, 475, 280	224, 683, 280	2, 425, 805, 879	1, 694, 861	1, 664, 069	186, 543, 084	1, 581, 802, 412	4, 163, 703	4, 139, 349	411, 226, 364	4, 007, 608, 291
1945	2, 416, 961	2, 464, 672	232, 545, 321	2, 658, 351, 200	1, 745, 627	1, 731, 060	202, 639, 074	1, 784, 441, 486	4, 162, 588	4, 195, 732	435, 184, 395	4, 442, 792, 686
1946	2, 513, 687	2, 567, 050	279, 711, 300	2, 938, 062, 500	1, 808, 282	1, 829, 531	250, 912, 645	2, 035, 354, 131	4, 321, 969	4, 396, 581	530, 623, 945	4, 973, 416, 631
1947	2, 629, 737	2, 683, 253	300, 474, 560	3, 238, 537, 060	1, 831, 975	1, 871, 099	254, 946, 244	2, 290, 300, 375	4, 461, 702	4, 554, 352	555, 420, 804	5, 528, 837, 435
1948	2, 664, 619	2, 760, 493	277, 160, 874	3, 515, 697, 934	1, 894, 136	1, 939, 241	257, 462, 667	2, 547, 763, 042	4, 558, 755	4, 699, 734	534, 623, 541	6, 063, 460, 976

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[1] Includes projects constructed by the United States and those for which supplemental water is furnished from storage works built by United States. [2] Estimated.

OPERATION AND MAINTENANCE

Operation and maintenance is the phase of Reclamation most closely integrated with the Bureau's entire program from the very first time an irrigation project is considered for construction until long after water has begun to flow down the ditch.

Operation and maintenance means providing irrigation water for more than 100,000 settlers on over 5 million acres of land, preparing lands for settlement where ultimately many times the present number of settlers will become Reclamation farmers, and last but not least to see that thousands of miles of irrigation facilities throughout the 17 Western States are kept in good working order to conserve and use the water to the greatest advantage and assure service to the people of that area.

Operation of the 60 irrigation projects, or divisions of projects, completed by the Bureau, including the use of water, maintenance of irrigation systems, the production of crops and livestock, and the general welfare of the water users on the land are problems of primary concern to every Reclamation employee from the man on the ditch to the Commissioner.

The Government has invested large sums of money in these projects and it is of paramount importance that they be maintained on a sound financial, agricultural and economic basis if the settlers are to succeed and the Government is to realize full return on its investment.

Noteworthy operation and maintenance accomplishments during the year were the large number of repayment and amendatory contracts which were executed in compliance with a directive from Congress. A report on this situation was made to Congress and to irrigation groups in February 1949.

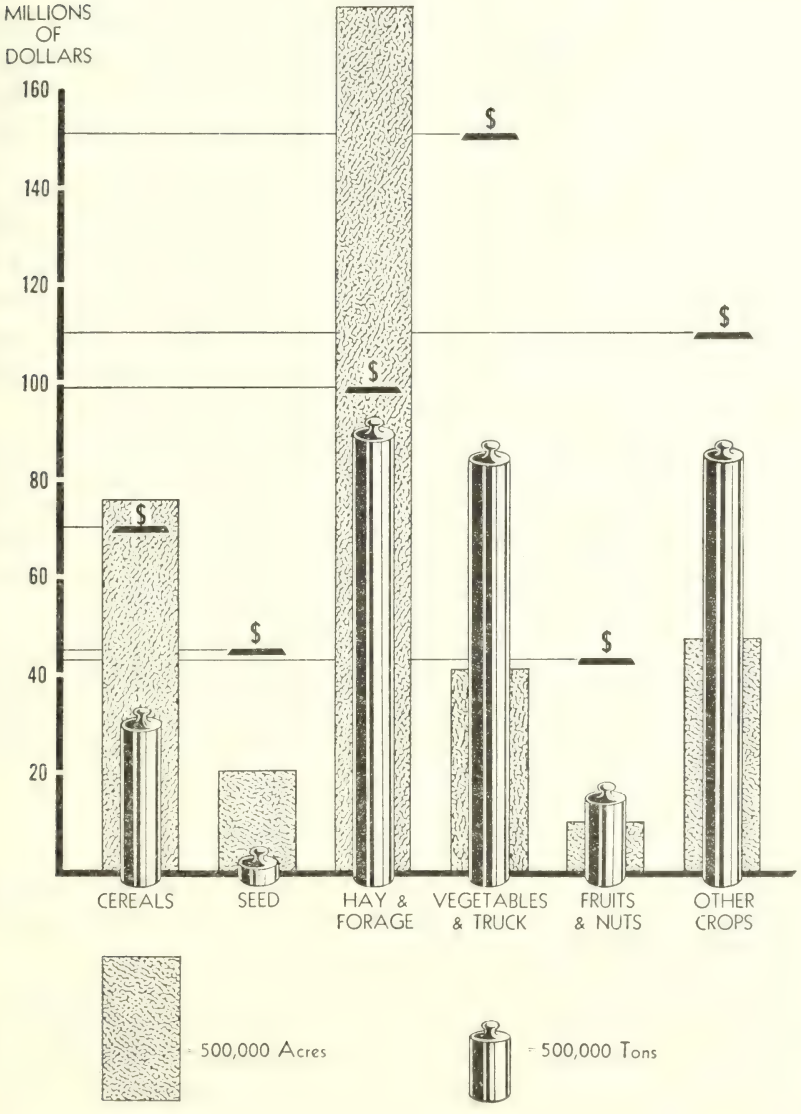
A considerable amount of work was completed under the newly launched rehabilitation and betterment program, progress was noted on the lower cost canal lining program, sprinkler irrigation studies, as well as continuing improvement in weed-control activities. Hundreds of veterans-settlers profited from the new development farms, as well as from the various agreements executed by the Bureau with the United States Department of Agriculture and State agricultural colleges. Through these agreements assistant county extension agents help advise in matters relative to crops and livestock, and advise on numerous other problems which confront new homesteaders.

Crop Production

Crops valued at $534,623,541 and averaging $113.76 per acre were produced in 1948 on 60 Federal Reclamation projects or divisions of

CROP RESULTS

on Federal Reclamation Projects in 1948



projects. This was the third consecutive year in which crop values exceeded one-half billion dollars despite some decline in prices. Of the value of crops produced, approximately 42 percent were food crops, 32 percent grain and forage, 11 percent cotton fiber, 10 percent seed crops (including cottonseed) and about 5 percent of the value was represented by miscellaneous crops and payments to water users by the Government and commercial agencies. The cumulative value of irrigation crops grown on Federal Reclamation projects since 1906 totals slightly more than 6 billion dollars.

The volume of crops harvested in 1948 totaled 13,258,688 tons. Prices received by farmers averaged somewhat lower and production costs continued at a high level. Significant shortages of surface water supplies were experienced on the Salt River, Rio Grande, Carlsbad, and Moon Lake projects.

The population on the 69,146 farms on regular Bureau projects and storage projects is estimated at 235,100 and the population on 23,322 farms served under Warren Act or special contracts is estimated at 93,400, making a total of about 328,500 people on 92,468 irrigated farms. Towns in and adjacent to these irrigation project areas, numbering about 370, have a population of approximately 1,298,000. The Reclamation area population therefore totals about 1,626,500.

Irrigated farms served by Federal Reclamation have increased from 86,181 in 1941 to 92,468 in 1948 and the over-all population of the farms and adjacent towns has increased during this same period from 1,088,500 to 1,626,500. In 1941, there were about 126 banks in which 237,600 depositors held about $269,000,000. In 1948, 563,400 depositors held $1,143,000,000 in 181 banking establishments.

The inventory value of livestock and equipment on Federal Reclamation projects as of November 1, 1948, was $221,273,287 which exceeded the previous year's value by $35,965,191. Livestock were valued at $99,253,237, and equipment, including motor vehicles, at $122,020,050.

Extension of Irrigation Service

Irrigation facilities were extended in 1948 by the Bureau whereby irrigation service could be provided for 5,380,015 acres, an increase of 213,232 acres over that of the previous crop year.

The area irrigated in 1948 totaled 4,458,755 acres, an increase of 97,053 acres over that of the previous crop year. Projects reporting the principal amount of this increase in acreage irrigated through facilities constructed by the Bureau include the following:

	Irrigated	
	Farms	Acres
Tucumcari project, New Mexico	123	9,823
W. C. Austin project, Oklahoma	227	14,160
Riverton project, Wyoming	65	4,200
Shoshone project, Wyoming	30	1,535
Buffalo Rapids project (second division), Montana	2	243
All-American Canal project, Coachella division, California	13	1,275
Gila project, Yuma Mesa division, Arizona	8	[1] 1,460
Kendrick project, Wyoming	15	682
Mirage Flats project, Nebraska	16	2,152
Colorado-Big Thompson project, Colorado	290	23,000
Newlands project, Nevada		372
Boise project, Payette division, Idaho	65	1,861
Deschutes project, north unit, Oregon	213	13,200
Deschutes project, Arnold irrigation district, Oregon	189	2,964
Minidoka project, Idaho	41	2,736
Yakima project, Roza division, Washington	255	6,408
Rathdrum Prairie project, Post Falls unit, Idaho	7	1,083
Central Valley project, California	208	7,422
Total [2]	1,821	94,576

[1] Does not include area irrigated by Bureau prior to 1948 which was divided into 54 farm units.

[2] Does not include area irrigated under lease prior to 1948 comprising 8,283 acres, on which 86 farm units were opened for homestead settlement on Klamath project in 1948.

The difference between the acreage for which irrigation facilities have been provided and the acreage irrigated is due principally to the need for allowing land to fallow for a season and, to a lesser degree, to the need for completion of distribution systems.

Operation and Maintenance of Irrigation Systems

During the year, activities relating to the operation of storage, regulation, and distribution of irrigation water supplies were the prime business on operating projects. Irrigation water was delivered to the water users during fiscal year 1949 without a major break in the distribution system of any Bureau-operated project. Crops were profitably matured on all operating projects during the year despite some water shortages which occurred in the Southwest. On some projects where surface water was not adequate, ground water was pumped to supplement surface water supply. Programs for the control of irrigation transmission losses, sprinkler irrigation, reuse of return flows, project rehabilitation, and other items of water conservation were aggressively pursued so that the full utilization of our water resources might be accomplished.

In accordance with established congressional and Bureau policy, three projects were transferred to the waters users for operation during the year. These were Grand Valley in Colorado, Belle Fourche in South Dakota, and Vale in Oregon. Negotiations are now under way for the transfer of the Carlsbad project in New Mexico to the water users.

Additional drains were constructed to relieve areas of high ground water, and surveys were made to determine the extent and solution of future drainage problems.

Cooperation With Design and Construction

As cooperation is a "must" between experienced operation and maintenance personnel and the planning and designing forces in any large construction organization, the Chief Engineer has taken positive steps to make certain members of both branches cooperate in ironing out possible future problems which may arise in the design stage of any structure.

He is arranging for the appointment of an engineer experienced in both design and operation, whose chief duty will be to find examples of unusually good or bad operating results and pass this information along to the designing staff. In some regions, groups of designers have inspected operating projects with operating personnel, who point out the salient favorable or unfavorable features of the development. A start has been made toward the collection and analysis of recent water records for use in checking past plans and making new ones.

Sprinkler Irrigation

Sprinkler irrigation gives promise of making possible the satisfactory irrigation of lands which can be irrigated by surface methods only with great difficulty, if at all. Since certain Bureau projects contain large areas of land of this character, the Bureau initiated a rather thorough investigation of the possibilities. Upon the conclusion of this investigation, an extensive report was prepared. It is titled "Sprinkler Irrigation" and copies are now available to the public. These may be purchased for 20 cents each. Requests should be sent to the Superintendent of Documents, Government Printing Office, Washington 25, D. C.

Sprinkler systems have been installed by the Bureau of Reclamation on the Columbia Basin project in Washington, the Missouri River Basin project in both North and South Dakota, and the Gila project in Arizona. In these areas many types of systems are being used on a large variety of crops and under a wide range of conditions.

These systems will be operated long enough to provide definite results. The preliminary reports are favorable. Conclusions so far are that sprinkler irrigation is well-established as a successful practice with most crops and on most arable lands. It does not yet appear to be as economical or otherwise superior to surface methods on lands well-adapted to the latter.

Income Taxes From Reclamation Areas

Income-tax revenues from Federal Reclamation projects areas represent a return on the Federal investment above and in addition to the return of the construction costs by the irrigators and from power revenues.

Estimates have been made of the Federal individual income taxes paid from seven selected project areas, including the territory and town adjacent thereto. These seven Federal Reclamation areas paid almost 63 million dollars of individual income taxes in 1948 and more than 300 million dollars have been paid since 1916, when Federal income taxes were initiated. The construction costs through June 1948 for these projects total about 132 million dollars. Thus, the individual income-tax revenue has already amounted to almost 2½ times the Federal project costs. The estimates for the individual areas are as follows:

Project area	1948	Total
	Thousands	*Thousands*
Salt River project area, Arizona	$26, 700	$136, 600
Yuma project area, Arizona-California	2, 600	14, 700
Boise project area, Idaho	10, 850	46, 800
Yakima project area, Washington	21, 500	120, 300
Shoshone project area, Wyoming	309	2, 360
Sun River project area, Montana	419	2, 543
Lower Yellowstone project area, Montana-North Dakota	395	3, 435
Total	62, 773	326, 738

The individual income taxes paid from these areas in 1948 amount to about $50 per irrigated acre, and the total taxes paid since 1916 equal almost $300 per acre. These tax revenues represent not only taxes paid by irrigation farmers but also the taxes paid by the individuals of the nearby towns and villages whose business or employment depends upon the Reclamation development.

In addition to the above tax revenues, an appropriate share of corporation income taxes and other Federal taxes are either directly or indirectly attributable to business and industrial activity resulting from Reclamation developments. Rough estimates of these additional Federal taxes were made of Maricopa County, Ariz., which represents the Salt River project area. These additional Federal revenues, plus the $27,000,000 of individual income taxes, would raise the total Federal tax revenue from that area in 1948 to over 60 million dollars. The inclusion in the estimate of all Federal taxes would raise the above figure for the seven project areas to more than 80 million dollars for 1948 and to more than 400 million dollars for the period 1916–48.

It is roughly estimated that about 1.2 billion dollars of individual income taxes or more than 1.6 billion dollars of all Federal taxes have been paid into the Treasury since 1916 from all Federal Reclamation areas. This compares with a Federal construction cost on these projects of less than 500 million dollars. These estimates do not include projects under construction such as Columbia Basin, Central Valley, and Missouri Basin, nor power developments at Hoover, Fort Peck, Parker, and Davis Dams.

Amendatory and New Repayment and Water Service Contracts

During the fiscal year 1949 notable progress was made in developing standards and procedures for repayment contract negotiations, in sorting out and classifying repayment problems, and in identifying and evaluating basic considerations in determining project payment ability.

Negotiation and execution of repayment contracts for new projects and units of projects exceeded the pace set in fiscal year 1948 to keep up with the accelerated construction program.

Under the authority of the Reclamation Project Act of 1939, investigations were continued into the repayment problems of operating projects. Fiscal year 1949 saw the first substantial harvest of amendatory repayment contracts from investigations initiated in prior years as part of a coordinated program of investigations of the financial and repayment status of operating Reclamation projects. These amendatory contracts are designed to eliminate inequities in existing contracts and put the water users on a sound financial base. In most cases the significant change involved an adjustment of annual payments from an arbitrary basis to one which conforms more closely to the water users' ability to pay based on economic analyses of the projects. Two important principles recognized in most of these contracts are: (*a*) That water users' ability to make payments varies from year to year—provision of a formula to vary annual payments accordingly, and (*b*) that unusually large and unforeseen maintenance expenses can throw an otherwise healthy project off-balance—provision made for accumulation of a specific reserve fund to take the shock out of such emergencies.

During fiscal year 1949 a total of 12 amendatory, supplemental, and interim repayment contracts were executed. Six of these were contracts negotiated under provisions of section 7 of the Reclamation Project Act of 1939 and congressional approval obtained through Public Law 56, Eighty-first Congress, first session. These contracts were executed with the following water users' organizations:

Colorado: Uncompahgre Valley Water Users' Association, Uncompahgre project (Public Law 56).

Idaho: Lewiston Orchards irrigation district, Lewiston Orchards project; American Falls Reservoir district No. 2, Minidoka project.

Montana: Bitter Root irrigation district, Bitter Root project (Public Law 56).

Oregon: Shasta View irrigation district, Klamath project (Public Law 56); Jefferson water conservancy district, Deschutes project.

Utah: South Ogden conservation district, Ogden River project.

Washington: Roza irrigation district, Yakima project; Kittitas Reclamation district, Yakima project (Public Law 56); Okanogan irrigation district, Okanogan project (Public Law 56).

Wyoming: Midvale irrigation district, Riverton project; Willwood irrigation district, Shoshone project (Public Law 56).

Section 7 negotiations were completed on six other amendatory contracts which were pending consideration of Congress at the close of the fiscal year as Senate bill 2089 and House bill 5184. These contracts involved the following water users' organizations:

Oregon: Vale Oregon irrigation district, Vale project; Stanfield irrigation district, Umatilla project; Westland irrigation district, Umatilla project.

South Dakota: Belle Fourche irrigation district, Belle Fourche project.

Washington: Prosser irrigation district, Yakima project.

Wyoming: Deaver irrigation district, Shoshone project.

In addition, negotiations were well advanced during fiscal year 1949 on the following:

Idaho: Black Canyon irrigation district, Boise project; Owyhee project (eight districts).

Montana: Malta irrigation district, Milk River project; Glasgow irrigation district, Milk River project; Frenchtown irrigation district, Frenchtown project.

Oregon: Hermiston irrigation district, Umatilla project; West Extension irrigation district, Umatilla project.

Financial adjustment investigations or negotiations for supplemental contracts were initiated or programmed during fiscal year 1949 with 42 more water users' organizations.

In connection with construction of new projects or units of projects, the repayment contract program involved negotiation of (1) water service contracts under the provisions of section 9 (e) of the Reclamation Project Act of 1939, (2) repayment contracts under section 9 (d) of the same act or other comparable legal provisions, and/or (3) combination water service and repayment contracts. Under the combination plan, the cost of the distribution system is contracted for repayment under section 9 (d) and water service is provided under section 9 (e), both in the same contract.

During fiscal year 1949, 15 new repayment contracts were executed with the following water users' organizations:

Arizona: City of Phoenix, Salt River project.
California: Lindsay-Strathmore irrigation district, Central Valley project; Summit City public utility district, Central Valley project; Lindmore irrigation district, Central Valley project; Orange Cove irrigation district, Central Valley project.
Colorado: Conejos water conservancy district, San Luis Valley project.
Idaho: Preston, Riverdale, and Mink Creek Canal Co., Preston Bench project; Hayden Lake irrigation district, Rathdrum Prairie project.
Nebraska: Bostwick irrigation district, Missouri River Basin project.
New Mexico: Fort Sumner irrigation district, Fort Sumner project; city of Tucumcari, Tucumcari project.
Montana: Savage irrigation district, Missouri River Basin project.
Oregon: Arnold irrigation district, Deschutes project.
Texas: Lower Colorado River Authority, Marshall Ford project; city of El Paso, Rio Grande project.

At the close of the fiscal year, negotiations had been completed on seven additional new contracts which were pending formal execution by either the water users or the Government. These involved the following water users' organizations:

Arizona: North Gila Valley irrigation district, Gila project.
California: Ivanhoe irrigation district, Central Valley project; Santa Barbara County Water Agency, Santa Barbara County project.
Colorado: North Fork water conservancy district, Paonia project.
North Dakota: City of Dickinson, Heart division, Missouri River Basin project; Heart River irrigation district, Heart division, Missouri River Basin project.
Oregon: Ochoco irrigation district, Deschutes project.

In addition, detailed physical and economic investigations were completed and negotiations well advanced on seven repayment contracts on the Central Valley project, and one on the Frenchman-Cambridge unit of the Missouri Basin project.

Rehabilitation and Betterment

Following the inflexible demands on manpower, equipment, and supplies of World War II, deferment in maintenance of Reclamation and irrigation projects accumulated.

These conditions, coupled with the high postwar costs, have continued almost up to the present time. Consequently, there is a backlog of delayed operation and maintenance work, which, in the best interests of Reclamation projects, cannot be longer delayed.

The cost of performing this backlog of delayed operation and maintenance work is, in practically all cases, beyond the ability of the districts to finance on a current basis, particularly when considered in connection with the relatively high and increasing annual operation and maintenance costs. The cost of the delayed work will be met by the water users by installments over a sufficient number of years.

By placing these projects in good operating condition now, crop losses, which may occur through interruption in water service, are avoided and precious irrigation water is husbanded and conserved through the repair, replacement, improvement, and modernization of the many existing deteriorated and leaky wooden structures and other irrigation features that will bring project irrigation systems and works to an efficient operating condition. It will also result in lower future operation and maintenance costs, and improved service.

An inventory of the rehabilitation and betterment needs of the existing projects was initiated following the war, and an improvement program was started on a limited scale in fiscal year 1949 when Congress appropriated one and a half million dollars for this purpose.

Obviously, only the more urgent needs of a few projects could be undertaken with these funds. In making the appropriation, Congress pointed out that work should be done first on those projects with smaller monetary requirements, and that any remaining funds be used to carry out rehabilitation and betterment on those projects where needs were most urgent.

Projects that have received allotments from the 1949 appropriation and on which rehabilitation is now completed or progressing rapidly are as follows:

Project:		Project:	
Yakima, Wash	$505,750	Riverton, Wyo	$150,000
Bitter Root, Mont	40,000	Belle Fourche, S. Dak	45,000
Orland, Calif	135,750	North Platte, Nebr.-Wyo	500,000
Milk River, Mont	73,500	Sun River, Mont	20,000
Shoshone, Wyo	30,000		
		Total	1,500,000

Examples of some of the work performed are as follows: On the Fort Shaw unit of the Sun River project in Montana a 6-mile drainage system was completed, resulting in the rehabilitation of 600 acres of land; work on the replacement of a high-line flume on the Orland project in California was nearing completion. The entire project will benefit from this repair along with the planned replacement of gates for Stony Gorge and East Park Dams, and other general improvements either under way or planned; on the Willwood division of the Shoshone project a new drainage system was nearing completion which would guarantee protection to the entire acreage of the Willwood division, and work was progressing rapidly on the replacement of deteriorated wooden structures that have been in service for over 20 years.

Public-Land Openings

Ever since the first postwar public-land opening was held on the Klamath project in Oregon and California at the close of 1946, Nation-wide interest has been expressed in the remaining Reclamation public-land units.

While the number of remaining farm units is relatively limited, each time the Bureau announces a new public-land opening, a flood of applications pours in. As an example of the interest shown, an announcement of the homestead drawing held on Minidoka project on March 3, 1949, resulted in requests for 9,601 copies of the public notices, for which 1,112 ex-servicemen qualified and 46 public-land farm units embracing 4,465 acres on the Hunt unit were awarded to lucky veterans.

Five land openings covering public land on four projects and private land on one project were held during the past fiscal year. Inquiries regarding the first three of these (latest figures available at the time the report went to press) exceeded 36,000. The total area involved, public and Government acquired, was 30,728 acres, which were to be divided into 296 farm units. Of these, 846 acres comprising 10 units were Government-acquired lands on the Columbia Basin project in Washington which were sold to prospective settlers. These marked the first lands served by the irrigation facilities of this 1,000,000-acre project. Gradually the number of acres which will be irrigated will increase and the number of units available for resale to individuals will rise accordingly.

The Bureau will have 87,000 acres of this, its biggest individual irrigation project, available for settlement by 1952.

Veterans, under existing law, in all cases involving public lands have a 90-day preference period in which to apply for homestead units.

So far, most veteran homesteaders, at the close of the first year that they have been on the land, have reached the stage where they are building homes, establishing residence on their entries, and have cleared, leveled, and cultivated a portion of their land.

Land openings for the fiscal year 1949 and those scheduled for 1950 are:

Project	Irrigated farms			
	1949		1950	
	Acreage	Units	Acreage	Units
Columbia Basin [1]	846	10	1,300	20
Klamath	8,283	86		
Minidoka	3,618	46		
Shoshone	12,070	104		
Riverton	5,911	50	14,400	103
Boise-Payette division			4,489	50
Yakima Roza			723	11
Total	30,728	296	20,912	184

[1] These lands are not made available to individuals in the same manner as public lands. The Bureau of Reclamation is acquiring them for resale to prospective homesteaders. The veterans' preference will prevail in the resale of these lands the same as in the case of public lands.

Settler Assistance and Land Development

The Bureau of Reclamation has both a moral and legal responsibility for seeing that settlers on Bureau of Reclamation projects have adequate technical assistance. It is concerned with the financial success and the consequent level of living of farm families on its projects. Furthermore, the Bureau is responsible for obtaining repayments of construction costs allocated to irrigation. It thus cannot escape its responsibility for seeing that everything necessary is done to enable settlers to obtain sufficient income to support their families at an adequate level of living and repay their obligations to the Government.

It is the policy of the Bureau, however, to encourage other agencies—local, State and Federal—to render the maximum amounts of the required assistance which their programs and facilities will permit, with the Bureau rendering only that assistance within the limitation of its program and facilities not rendered by other agencies. Such cooperative relations in settler assistance work may be provided for by either formal or informal agreements.

Cooperation in Settler Assistance

Settler assistance in many cases is provided for through formal agreement with State colleges of agriculture providing for the employment of assistant county agents who give special assistance to settlers on specified Bureau of Reclamation projects. Under the terms of these agreements the State agricultural extension service employs assistant county agents who are approved by the Bureau of Reclamation, but who work under the supervision of the State extension service. The extension service pays the salaries and office expenses of these assistant county agents, but the Bureau of Reclamation reimburses the extension service for the salaries paid.

Memoranda of understanding are now in effect with the respective State colleges of agriculture providing for the employment of assistant county agents on the following projects: Columbia Basin, Yakima, Owyhee, and Deschutes in Washington; Boise in Idaho; Shoshone, Riverton, and Kendrick in Wyoming; Vale in Oregon; and Milk River in Montana.

Much of the cooperative settler assistance work is provided for through informal agreements with various local, State and Federal agencies. Where several agencies such as the Farmers Home Administration, Soil Conservation Service, Production and Marketing Administration, Rural Electrification Administration, and the extension service are in position to cooperate in settler assistance work, representatives of these agencies formulate a program outlining the type of assistance which each agency is in position to render. This program usually is prepared in pamphlet form and made available to the settlers in order that they may be informed where to go for the several types of assistance needed. Programs of this type have been carried out on the Shoshone, Minidoka, Yakima, Klamath, Gila, and Yuma projects where farms have been opened to settlement during the past 3 years.

Development Farms

As a part of its settler assistance program the Bureau is conducting development farms for the purpose of demonstrating approved practices in farm layout, irrigation methods, cultural practices, weed control, etc. In all cases the site for such development farms is selected in cooperation with the respective State agricultural colleges. The annual program for the development farm is formulated in cooperation with the State colleges. In some cases, such as on the Columbia Basin Project, the Bureau of Plant Industry and the Soil Conservation Service of the United States Department of Agriculture also cooperate in the development farm program. In most cases a portion of the development farm is set aside for experimental work conducted by the State college and/or Department of Agriculture agencies.

Eight development farms are now in operation. Three of these, namely, Moses Lake, Winchester and Pasco are located on the Columbia Basin project in Washington; one is on the Milk River project in Montana while four are on the Missouri River Basin project, two of which are in North Dakota at Bowbells and Mandan, and two in South Dakota at Huron and Redfield. The program on some of these farms is just getting under way, this being the first year of operation. These demonstrations will be of increasing interest as the program continues. All of the farms, with the exception of the one at Milk River, are located in new areas where irrigation is just getting under way or will be initiated during the next few years. In addition to demonstrating approved irrigation practices the farms will serve to show the results which may be expected from irrigation.

Land Development

In addition to technical assistance as outlined above, settlers on many projects are in need of actual assistance in land development including clearing, rough leveling, and the roughing in of farm irrigation and surface drainage ditches. Such assistance is furnished either by the Bureau itself or through informal agreements with Department of Agriculture agencies. On several projects consisting primarily of privately owned land, arrangements have been made whereby the Soil Conservation Service is giving special assistance to new irrigation farmers in the lay-out of the farm irrigation system, arrangement of farm fields, clearing and leveling of land and establishing crop rotations. In such cases Bureau of Reclamation representatives cooperate with Soil Conservation Service personnel by supplying them with all available information such as land classification data, topographic maps and engineering plans.

On public land projects the Bureau, in appropriate cases, gives direct assistance on a reimbursable basis in the development of farm units including clearing and rough leveling the land and roughing in of farm irrigation and surface drainage system beyond the farm turn-out. In these cases the individual settlers make application for land development work and agreement is reached as to the nature and extent of the work to be done. The Bureau performs the work with its own equipment and the settler makes payment for this work over a period of years.

Weed Control

One of the most important functions of the Branch of Operation and Maintenance is its weed-control program. Special investigations concerning the water losses and operation and maintenance costs created by weed growths on irrigation distribution and drainage systems and project farms as well as the ditchbanks adjacent thereto were completed this year. These studies provided the basis for a publication entitled "Control of Weeds on Irrigation Systems" which is now available to the public. It might well be termed a "Weed" manual and will be of interest and assistance to every irrigation farmer, county agent and all various State and Federal officials who have to deal with the weed problem in any way. Copies may be obtained for 35 cents by writing to the Superintendent of Documents, United States Government Printing Office, Washington, D. C.

This publication was prepared with the full cooperation of numerous Federal and private irrigation districts, experimental stations, the extension service, and various other Federal, State, and county agencies, along with the Bureau of Plant Industry, and Soils and Agricultural Engineering, Department of Agriculture.

The publication describes the combined investigations which led to the finding of and adapting of new chemical methods for solving various weed problems. One such method developed in the Bureau's Denver Chemical Laboratory has reduced the cost for chemicals to about one-tenth of those previously used for the control of water weeds. These pests often prevent efficient delivery of water, cause excess seepage, necessitate costly dredging of silt deposits and reduce the effectiveness of drains.

The introduction of methods, determined through research, for controlling canal bank weeds and willows has materially reduced maintenance costs and has allowed more extensive control operations. This is resulting in the more effective elimination of these types of weeds which cause operation problems and transpire an estimated million acre-feet of water per year on Federal and private irrigation projects.

The educational weed-control program carried out for the benefit of project farmers through cooperation with Federal, State, and county organizations is resulting in more effective weed control on croplands. This, in turn, increases farmers' profits and helps protect the Government's investment in Reclamation projects because of the increased repayment ability. In addition to the program for controlling existing weed infestations, special consideration is given to prevention of weed growths, especially on new projects.

The research work, together with a regional weed-control program, is changing weed-control activities from costly, temporary and haphazard guesswork to an orderly program based on scientific methods.

Soil and Moisture Conservation Operations

The Bureau of Reclamation participates in the Department's soil and moisture conservation program, looking toward effective control of accelerated erosion on the 14,500,000 acres of public lands under Reclamation's jurisdiction; protection of its reservoirs, canals, and other irrigation works from siltation; and prevention of water losses detrimental to irrigation projects. Within the limit of the funds made available to the Bureau for these purposes, surveys to delineate our worst problem areas and enable programming of remedial measures to be taken thereon, and an action program for restoring some of the depleted lands and affecting a reduction in water losses, were continued during the past fiscal year. More specifically, the work consists of: (*a*) Revegetation of overgrazed or denuded lands; (*b*) the development of water diversions and water spreading devices designed to provide flood irrigation of otherwise dry lands and to eliminate water losses; (*c*) gully control through planting of trees, shrubs, and grass, together with the construction of check dams and water drops; and (*d*) other soil and moisture conservation measures for specific conditions.

Recreational Use of Reservoirs

Construction of dams and reservoirs for irrigation and power development provides incidental but very definite benefits to the public through the creation of exceptional recreational opportunities. This is particularly true in the more arid parts of the West where a Bureau of Reclamation reservoir may be the only body of water of any size within hundreds of miles. At the larger reservoirs, such as Lake Mead, on the Colorado River between Arizona and Nevada; Franklin

D. Roosevelt Lake (Grand Coulee) in Washington; and Millerton Lake in California, the administration of recreational facilities is handled for the Bureau by the National Park Service. At certain other reservoirs which are located within National Forest boundaries, recreational facilities are administered by the United States Forest Service. At a few of the smaller reservoirs, the Bureau operates necessary recreational facilities directly and does, in some instances, award concessions for boating and leases for cabin sites. During the past fiscal year, the Bureau has been planning development of a program for optimum recreational use of all of its existing reservoirs, as well as for those under construction or still under investigation. As a prerequisite to achievement of such a program, legislation is required to provide for the expenditure of nonreimbursable funds for development and administration of these recreational resources.

Payments to School Districts

Assistance to school districts, on which an undue financial burden is or will be placed by reason of Federal Reclamation construction activities, was provided under Public Law 835 (general legislation) and Public Law 841 (Interior Department appropriation bill, 1949). The administrative proviso in Public Law 841 authorized payments to school districts, provided the Bureau of Reclamation charge and collect tuition in the amount of $25 per semester for each dependent of Bureau employees and of contractor employees attending such schools. The requirement for the collection of tuition was contrary in many States to constitutional or statutory provisions of free public schooling. As a consequence, the Bureau during fiscal year 1949 was unable to provide, under this legislation, an appropriate measure of assistance to unduly burdened school districts. Clarifying language included in the Secondary Deficiency Appropriation Act of 1949 places the administration of school payments under the provisions of Public Law 835. At the close of the fiscal year, an order outlining the basic principles for the administration of the act was being prepared for consideration by the Secretary. The proposed order delegates authority to the Commissioner of Reclamation for administration of the Act.

POWER UTILIZATION

During the past year unsatisfied demands for electric power in the Western States continued to increase. Great emphasis has been placed on the power shortage in the Pacific Northwest. Although this area is still faced with serious shortages, other areas receiving less public attention are experiencing deficiencies in power supply which are equally serious handicaps to their future growth.

Typical power shortage areas are in the Southwestern States and the Missouri River Basin States. Applications for power to be generated at the Davis Dam power plant, located approximately 80 miles downstream from the Hoover power plant, were almost four times the firm capacity output. In the Missouri Basin States of North Dakota, South Dakota, Minnesota, Iowa, Nebraska, and Missouri, the applications for firm power to be generated initially at Fort Randall and Garrison power plants, located on the Missouri River, were almost three times the initial block of firm power. The Western States in general are deficient in electric generating capacity. Development of potential mineral resources have been deferred due to lack of an adequate source of power. Rural cooperatives have either retarded their expansion into new areas or have resorted to the installation of higher cost steam plants to meet the increased demands. Power requirements for irrigation pumping, municipal and industrial uses in Arizona have remained unsatisfied. The entire output of Davis Dam for use in Arizona will be immediately utilized for irrigation pumping and other uses as soon as it is placed in operation in fiscal year 1951. Additional capacity now being installed at the Hoover power plant will also be fully utilized as rapidly as it can be installed. The rapidly increasing population of California which contributes to increased industrial and agricultural expansion continues to place heavy demands on existing power facilities although generating capacity, both public and private, is being installed as rapidly as possible. Power shortages will still threaten for some years to come. Since practically one-half of the installed capacity in the Central Valley is in hydrodevelopments, additional steam capacity is required to assure adequate protection to the power users during the periods of drought and low run-off, as was the experience during 1948.

In all of these areas the development of irrigation pumping, both public and private, has given great impetus to the demand for electric power. Tapping underground sources of water supply for irrigation purposes can well expand the development of arid lands which cannot be supplied directly by canals from water storage structures. The construction of transmission lines into these areas will permit the utilization of lower cost project power for greater expansion of agricultural irrigation developments than has been known heretofore. If the trend in the use of sprinkler irrigation continues, even greater demands will result. The extension of this type of irrigation, which has been confined to relatively small areas in the past, leads to a new concept in the irrigation of arid lands that cannot be economically developed by canal and ditch type irrigation. The sprinkler type of irrigation gives the farmer better control of the application of water, and results in conservation measures which may provide more widespread utilization of the existing water supply.

Greater application of electric power for farm use, coupled with increased industrial activities and the extraction of vast mineral resources by more modern techniques, will continue to place increasingly heavier demands on the power systems of the West. The development of the water resources now going to waste through lack of adequate development can and should be harnessed to assure broad scale development of the western half of the United States.

The Bureau of Reclamation has planned its construction program to meet the increased power requirements, insofar as possible, consistent with the full development of the water resources of the West for irrigation and other purposes.

Present Installed Capacity

During fiscal year 1949 the Bureau of Reclamation had in operation 17 power plants with a total installed capacity of 2,757,400 kilowatts. The increase of 263,000 kilowatts capacity resulted from the addition of one 108,000-kilowatt generating unit at Grand Coulee power plant on the Columbia Basin project, two 75,000-kilowatt units at Shasta power plant on the Central Valley project, the last of 5 units, and a 5,000-kilowatt generating plant at Heart Mountain on the Shoshone project. Power plants operated by others on Reclamation projects total 16, of which 9 were constructed by the Bureau of Reclamation with a total installed capacity of 30,827 kilowatts, and 7 were constructed by others with a total installed capacity of 62,900 kilowatts.

One of the most significant events during fiscal year 1949 was the installation of the first unit in the right powerhouse at Grand Coulee Dam, bringing the total nameplate capacity of the Grand Coulee power plant to 1,100,000 kilowatts, the largest in the world.[1]

Additional Capacity Under Construction

During the fiscal year 1949, 10 new power plants, which will have an ultimate capacity of 892,100 kilowatts, were under construction by the Bureau of Reclamation. Contracts were awarded for turbines and generators for two additional 82,500-kilowatt units at the Hoover power plant of the Boulder Canyon project. Construction was continued on the Keswick Dam and power plant of the Central Valley project which will have an installed capacity of 75,000 kilowatts in three generating units. Upon the completion of this power plant during fiscal year 1950, the Central Valley project will have a total installed capacity of 454,000 kilowatts in the Shasta and Keswick power plants.

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[1] This record was surpassed early in fiscal year 1950 when the tenth unit was placed in commercial operation on July 9, 1949, bringing the capacity of the plant to 1,208,000 kilowatts.

The Marys Lake power plant of 8,100 kilowatts capacity and the Estes power plant of 45,000 kilowatts capacity, now under construction on the Colorado-Big Thompson project in Colorado, are scheduled for initial seasonal operation during the spring of 1950. This will bring into operation the initial phase of the eastern slope power development of this project. Work is progressing on the addition of approximately 100,000 kilowatts of capacity to develop the power drop between the Estes power plant and the Foothills storage system of the project. This capacity is scheduled for initial operation in fiscal year 1953.

On the Missouri Basin project, the Kortes power plant of 36,000 kilowatts capacity near Seminoe Dam in Wyoming is scheduled for initial operation during the spring of 1950. Work is progressing on the completion of Boysen Dam and power plant in the Big Horn Basin in Wyoming. The power plant of 15,000-kilowatt capacity is scheduled for operation in fiscal year 1952. Davis Dam and power plant, located on the Colorado River, will have an installed capacity of 225,000 kilowatts and is scheduled for operation in the spring or early summer of 1951.

The power plant at Anderson Ranch Dam in Idaho will have an initial installed capacity of 27,000 kilowatts and is scheduled for operation in the spring of 1950. The Hungry Horse Dam and power plant of 285,000 kilowatts, now under construction on the South Fork of Flathead River in Montana, is scheduled for initial operation in October 1952; the second unit in operation by December 1952. The last two units are scheduled for operation in August and November of 1953.

The Canyon Ferry Dam in Montana is now under construction. The power plant is scheduled for initial operation in 1954, although restrictive language in the appropriations bill for fiscal year 1949 prevented the Bureau of Reclamation from initiating work on the design and purchase of the necessary generating and electrical equipment. On the Fort Peck project in Montana, the Corps of Engineers is progressing on the installation of a third unit which will have a capacity of 35,000 kilowatts. Operation is scheduled for fiscal year 1952. The Corps of Engineers, Department of the Army, has under active construction the Garrison Dam in North Dakota and the Fort Randall Dam in South Dakota. Although power requirements of the area indicate the immediate need for generating capacity, the initial operating schedule for Garrison and Fort Randall power plants are tentatively 160,000 kilowatts capacity in fiscal year 1953 at Fort Randall, and 240,000 kilowatts in fiscal year 1954 at Garrison. Actual progress which can be made is contingent upon appropriations to meet these schedules. The schedule of the power plants in various stages of construction but not in full operating status are shown in table 9.

TABLE 9.—*Hydroelectric plants on Reclamation projects—operating, under construction, or authorized as of June 30, 1949*

CONSTRUCTED AND OPERATED BY BUREAU OF RECLAMATION

State	Project	Name of plant	Year of initial operation	Present nameplate capacity (kilowatts)	Ultimate nameplate capacity (kilowatts)	Present number of generators and capacities (kilowatts)	Ultimate number of generators and capacities (kilowatts)
Arizona-Nevada	Boulder Canyon	Hoover [1]	1936	1, 034, 800	1, 332, 300	Twelve 82,500; one 40,000; two 2,400.	Fifteen 82,500; one 40,000; one 50,000; two 2,400.
Arizona-California	Parker	Parker	1942	120, 000	120, 000	Four 30,000	Four 30,000.
California	Central Valley	Shasta	1944	379, 000	379, 000	Five 75,000; two 2,000	Five 75,000; two 2,000.
Do	Yuma	Siphon Drop	1926	1, 600	1, 600	Two 800	Two 800.
Colorado	Colorado-Big Thompson	Green Mountain	1943	21, 600	21, 600	Two 10,800	Two 10,800.
Idaho	Boise	Boise Diversion	1912	1, 500	1, 500	Three 500	Three 500.
Do	do	Black Canyon	1925	8, 000	8, 000	Two 4,000	Two 4,000.
Do	Minidoka	Minidoka	1909	13, 400	13, 400	One 5,000; one 2,400; five 1,200	One 5,000; one 2,400; five 1,200.
Wyoming	North Platte	Guernsey	1927	4, 800	4, 800	Two 2,400	Two 2,400.
Do	do	Lingle	1919	1, 400	1, 400	Two 400; two 300	Two 400; two 300.
New Mexico	Rio Grande	Elephant Butte	1940	24, 300	24, 300	Three 8,100	Three 8,100.
Washington	Columbia	Grand Coulee [2] [3]	1941	1, 100, 000	1, 974, 000	Ten 108,000; [3] two 10,000	Eighteen 108,000; [3] three 10,000.
Do	Yakima	Prosser [4]	1932	2, 400	[4] 2, 400	One 2,400	One 2,400.
Wyoming	Kendrick	Seminoe	1939	32, 400	32, 400	Three 10,800	Three 10,800.
Do	Riverton	Pilot Butte	1925	1, 600	1, 600	Two 800	Two 800.
Do	Shoshone	Heart Mountain	1948	5, 000	5, 000	One 5,000	One 5,000.
Do	do	Shoshone	1922	5, 600	5. 600	One 4,000; two 800	One 4,000; two 800.
Subtotal				2, 757, 400	3, 926, 500		

CONSTRUCTED BY BUREAU OF RECLAMATION; OPERATED BY OTHERS

State	Project	Name of plant	Year of initial operation	Present nameplate capacity (kilowatts)	Ultimate nameplate capacity (kilowatts)	Present number of generators and capacities (kilowatts)	Ultimate number of generators and capacities (kilowatts)
Arizona	Salt River	Roosevelt	1909	15, 400	15, 400	Five 1,080; one 4,000; one 6,000	Five 1,080; one 4,000; one 6,000.
Do	do	Arizona Falls [5]	1913	850	850	Two 425	Two 425.
Do	do	Cross Cut [5]	1914	5, 100	5, 100	One 3,000; three 700	One 3,000; three 700.
Do	do	S. Consolidated [5]	1912	1, 600	1, 600	Two 800	Two 800.
Colorado	Grand Valley	Grand Valley (Palisades)	1932	3, 000	3, 000	Two 1,500	Two 1,500.
Nevada	Newlands	Lahontan	1911	1, 640	1, 920	Two 500; one 640	Three 640.
Oregon	Deschutes	Cove [6]	1946	1, 500	1, 500	One 1,500	One 1,500.
Utah	Strawberry Valley	Spanish Fork [7]	1908	1, 550	1, 550	Two 450; one 250; one 400	Two 450; one 250; one 400.
Washington	Yakima	Rocky Ford	1916	187	187	One 187	One 187.
Subtotal				30, 827	31, 107		

See footnotes at end of table.

TABLE 9.—*Hydroelectric plants on Reclamation projects—operating, under construction, or authorized as of June 30, 1949*—Continued

State	Project	Name of plant	Year of initial operation	Present nameplate capacity (kilowatts)	Ultimate nameplate capacity (kilowatts)	Present number of generators and capacities (kilowatts)	Ultimate number of generators and capacities (kilowatts)
CONSTRUCTED AND OPERATED BY WATER USERS' ORGANIZATIONS							
Arizona	Salt River	Chandler [8]	1919	600	600	One 600	One 600.
Do	do	Horse Mesa [8]	1927	30,000	30,000	Three 10,000	Three 10,000.
Do	do	Mormon Flat [8]	1926	7,000	7,000	One 7,000	One 7,000.
Do	do	Stewart Mountain [8]	1930	10,400	10,400	One 10,400	One 10,400.
California	All-American	Drop No. 3 [9]	1941	4,800	9,600	One 4,800	Two 4,800.
Do	do	Drop No. 4 [9]	1941	9,600	19,200	One 9,600	Two 9,600.
Oregon	Klamath	"C" Canal Drop [10]	1938	500	500	One 500	One 500.
Subtotal				62,900	77,300		
CONSTRUCTED AND OPERATED BY CORPS OF ENGINEERS, DEPARTMENT OF THE ARMY; POWER MARKETED BY BUREAU OF RECLAMATION							
Montana	Fort Peck	Fort Peck	1943	50,000	85,000	One 35,000; one 15,000	Two 35,000; one 15,000.
UNDER CONSTRUCTION BY BUREAU OF RECLAMATION							
Arizona-Nevada	Davis	Davis	1951	0	225,000	0	Five 45,000.
California	Central Valley	Keswick	1950	0	75,000	0	Three 25,000.
Colorado	Colorado-Big Thompson	Estes	1950	0	45,000	0	Three 15,000.
Do	do	Marys Lake	1950	0	8,100	0	One 8,100.
Idaho	Boise	Anderson Ranch	1950 [11]	0	[12] 40,500	0	Three 13,500.
Do	Palisades	Palisades	1954	0	[13] 112,500	0	Five 22,500.
Montana	Missouri Basin	Canyon Ferry [14]	1954	0	50,000	0	Three 16,667.
Do	Hungry Horse	Hungry Horse	1952	0	285,000	0	Four 71,250.
Wyoming	Missouri Basin	Boysen	1952	0	15,000	0	Two 7,500.
Do	do	Kortes	1950	0	36,000	0	Three 12,000.
Subtotal				0	892,100		
UNDER CONSTRUCTION BY CORPS OF ENGINEERS, DEPARTMENT OF THE ARMY; POWER TO BE MARKETED BY BUREAU OF RECLAMATION							
North Dakota	Missouri Basin	Garrison	1954	0	400,000	0	Five 80,000.
South Dakota	do	Fort Randall	1953	0	320,000	0	Eight 40,000.
Subtotal				0	720,000		

AUTHORIZED TO BE CONSTRUCTED BY BUREAU OF RECLAMATION

Colorado	Colorado-Big Thompson	Quillan	1953	0	28,500	0	Three 9,500.
Do	do	Cottonwood	1953	0	11,500	0	Two 5,750.
Do	do	Rattlesnake	1953	0	13,500	0	Two 6,750.
Do	do	Flatiron	1953	0	41,000	0	Three 7,000; two 10,000.
Do	do	Big Thompson	1953	0	6,700	0	One 6,700.
Montana	Missouri Basin	Angostura [15]		0	1,560	0	Two 780.
Do	do	Lower Marias (Kenil) [16]	1953	0	3,000	0	Three 1,000.
Do	do	Lyon	1959	0	24,000	0	Three 8,000.
Do	do	Mission		0	50,000	0	Three 16,667.
Do	do	Portage	1961	0	20,000	0	Two 10,000.
Do	do	Yellowtail	1954	0	[17] 120,000	0	Three 40,000.
Nebraska	do	Harlan [15]		0	1,200	0	One 1,200.
North Dakota	do	Crosby [16]		0	[13] 70,000	0	Four 17,500.
Do	do	Des Lacs [16]		0	[13] 70,000	0	Four 17,500.
South Dakota	do	Miller Drop [16]	1959	0	180,000	0	Four 45,000.
Washington	Yakima-Roza Division	Roza	1953	0	10,000	0	Two 5,000.
Do	Yakima-Kennewick Division.	Chandler [4]	1954	0	12,000	0	Two 6,000.
Wyoming	Missouri Basin	Bald Ridge		0	30,000	0	Three 10,000.
Do	do	Hunter Mountain		0	12,000	0	Two 6,000.
Do	do	Sunlight	1960	0	20,000	0	Two 10,000.
Do	do	Thief Creek	1957	0	60,000	0	Three 20,000.
Do	do	Tongue River		0	25,000	0	Two 12,500.
Subtotal				0	809,960		

AUTHORIZED TO BE CONSTRUCTED BY CORPS OF ENGINEERS, DEPARTMENT OF THE ARMY; POWER TO BE MARKETED BY BUREAU OF RECLAMATION

South Dakota	Missouri Basin	Big Bend	1959	0	[13] 120,000	0	Six 20,000.
Do	do	Gavins Point	1953	0	[13] 20,000	0	Two 10,000.
Do	do	Oahe	1959	0	[13] 490,000	0	Seven 70,000.
Subtotal				0	630,000		
Total (from this tabulation)				2,901,127	[4] 7,171,967		
Total (with Grand Coulee units figured at 120,000 kilowatts)				3,021,127	[4] 7,387,967		

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[1] Power plant units operated by power allottees under agency contract.

[2] Power marketed by Bonneville Power Administration.

[3] Main units with a nameplate rating at 108,000 kilowatts have continuous operating capacity of 120,000 kilowatts.

[4] Prosser will be removed when Chandler is built.

[5] Powerplant constructed by Bureau of Reclamation with Salt River Valley Water Users' Association funds.

[6] Unit No. 3 installed in Pacific Power and Light Company's plant.

[7] Three plants: (*a*) Spanish Fork (upper); (*b*) Spanish Fork (lower); (*c*) Payson.

[8] Constructed and operated by Salt River Valley Water Users' Association.

[9] Constructed and operated by Imperial Irrigation District.

[10] Constructed and operated by Enterprise Irrigation District.

[11] First two units completed.

[12] 27,000 kilowatts presently authorized.

[13] Capacity is tentative only, and may be revised.

[14] Powerplant foundations only.

[15] Construction deferred due to present high cost.

[16] Seasonal output to be used for irrigation pumping.

[17] Increase of present tentative capacity of 120,000 kilowatts to 200,000 kilowatts is now under study.

Additional authorized plants not presently under construction will consist of 22 power plants with a total installed capacity of 809,960 kilowatts. Additional power plants authorized for construction by the Corps of Engineers, from which the Bureau of Reclamation is responsible for marketing power, will total 630,000 kilowatts in three plants on the Missouri River.

Transmission Lines

At the close of fiscal year 1949, the Bureau of Reclamation had approximately 3,300 miles of high-voltage transmission lines in operation. During the fiscal year the principal lines placed in operation were approximately 25 miles of 230-kilovolt transmission line from Shasta power plant to the Shasta substation of the Pacific Gas & Electric Co.; 72 miles of 115-kilovolt line from Elephant Butte to Sorocco, N. M., on the Rio Grande project; initial operation at 33-kilovolt of the 100-mile Fort Peck to Bainville, Mont., section of the 115-kilovolt Fort Peck-Williston line; and initial operation of the 37-mile Beulah to Garrison section of the Williston-Garrison 115-kilovolt transmission line. Approximately 2,000 miles of additional high-voltage transmission lines were under construction during fiscal year 1949. These additional lines will be placed in operation during the next 2 or 3 years.

Electric Energy Sales

The Bureau of Reclamation operated 17 power plants during the fiscal year, and, under the provisions of the Fort Peck Project Act of 1938, marketed the output of the Fort Peck power plant operated by the Corps of Engineers. During this year the sales of electric energy, not including transactions between Bureau projects, totaled approximately 18,144,000,000 kilowatt-hours. The revenue from these sales reached an all-time high of approximately $32,000,000. This compares to a total of sales of 15,191,150,147 kilowatt-hours, and revenues of $25,342,811 during fiscal year 1948. Revenues for fiscal year 1949 exceeded previous estimates by approximately $6,000,000. A large part of this increase in revenue resulted from heavy demands for electric power, and integration of the Bureau hydroelectric systems with other existing systems to obtain maximum power production from the water resources. A summary of power sales and revenues by projects is shown in table 10.

TABLE 10.—*United States Department of the Interior, Bureau of Reclamation power systems, power sales and revenues by projects, fiscal year ending June 30, 1949* [1]

Project	Sales of electric energy (kilowatt-hours)	Revenues from sales of electric energy
Region I:		
Boise	38, 085, 432	$44, 504
Columbia Basin	9, 108, 463, 600	9, 175, 034
Minidoka	120, 503, 022	430, 779
Yakima	21, 791, 008	58, 229
Region II: Central Valley	1, 624, 006, 921	6, 523, 222
Region III:		
Boulder Canyon	5, 668, 155, 482	9, 259, 599
Parker	837, 348, 212	2, 985, 906
Yuma	9, 216, 184	42, 517
Region V: Rio Grande	74, 891, 173	388, 525
Region VI:		
Fort Peck	327, 261, 644	$950, 392
Riverton	28, 237, 924	189, 538
Shoshone	57, 246, 622	314, 886
Region VII:		
North Platte	38, 959, 104	419, 890
Kendrick	109, 710, 598	558, 938
Colorado-Big Thompson	80, 515, 874	697, 706
Total	18, 144, 392, 800	32, 039, 665

[1] Does not include energy sales and revenues in transactions between Bureau projects.

NOTE.—Data shown are preliminary and are subject to revisions.

Power Contracts

During fiscal year 1949, power was delivered to numerous major and minor users of power. Major deliveries were made to 26 municipalities, 7 State government agencies, 52 rural electric cooperatives, 3 Federal agencies, 45 public authorities, 24 commercial and industrial users, and 37 privately owned utilities. A summary by classification of customers for the 12 months ending June 30, 1949, is contained in table 11.

TABLE 11.—*Summary by classification of customers for 12 months ending June 30, 1949* [1]

	Number of customers	Sales of electric energy (kilowatt-hours)	Revenues from sales of electric energy
Privately owned utilities	37	4, 641, 092, 434	$12, 964, 070
Municipal utilities	26	3, 084, 206, 424	5, 063, 509
State government utilities	7	609, 415, 194	1, 974, 875
Cooperative utilities	52	88, 483, 666	659, 209
Other Federal utilities	3	9, 111, 691, 622	9, 272, 521
Residential and domestic	484	5, 019, 537	33, 402
Rural	4	72, 771	868
Commercial and industrial	24	61, 302, 343	400, 642
Public authorities	45	445, 482, 100	1, 445, 014
Interdepartmental	28	97, 611, 349	225, 335
Other sales	1	15, 360	220
Total, all customers		18, 144, 392, 800	32, 039, 665

[1] Does not include energy sales and revenues in transactions between Bureau projects.

During the year, 80 contracts for delivery of power were executed. These include 7 contracts with irrigation districts, 5 with other Federal bureaus and agencies, 2 with public power districts, 2 with State authorities, 17 with private utilities, 24 with rural electric cooperatives, 16 with municipalities, and 7 with other customers. A number of these contracts were renewals of expiring contracts or revisions resulting from changed conditions. The decrease in commercial and industrial customers shown in table 11, from 45 last year to 24 this year, resulted from consolidation of accounts. They occurred principally on the Rio Grande project where 21 accounts were merged into 2 accounts.

The contract between the Bureau and Montana-Dakota Utilities Co. was supplemented during the year to provide for service by the Bureau to additional preference customers, especially cooperatives in the Dakota system of the company. The wheeling arrangement, now in effect between Montana-Dakota Utilities Co. and the Bureau, has been instrumental in providing electric service to cooperatives not directly connected to Bureau transmission facilities. Similar wheeling arrangements are now under negotiation with other utilities in the Missouri River Basin area.

The Bureau of Reclamation, at the beginning of fiscal year 1949, had 114 contracts for delivery of power under negotiation. These include 58 with rural electric cooperatives, 16 with private utilities, 15 with municipalities, 9 with irrigation districts, 4 with State authorities, 4 with Federal agencies and bureaus, and 8 with other customers. A number of these are to renew existing contracts or to revise them to reflect changed conditions. Included in the above summary of contracts under negotiation are contracts with 20 cooperatives and irrigation districts to be served through arrangement with the Montana-Dakota Utilities Co. A large number of contracts under negotiation are for future power deliveries at such time as additional generating capacity now under construction is placed in operation.

PROJECT PLANNING

Investigations and Planning

Three events of major significance to the planning of water resource development occurred in the past fiscal year. Complete agreement between the Bureau of Reclamation and the Corps of Engineers was reached on a coordinated plan of water resource development for the Columbia River Basin and upon principles and responsibilities to guide the accomplishment of this plan. A compact between the States of the Upper Colorado River Basin on the division of their share of Colorado River water was consummated, thus clearing the way for development of specific plans for utilizing the water resources in the Upper Basin States. The Bureau of Reclamation initiated a program of water resource development in Alaska. All three of these events are ones that will lead to important water resource development programs over the next half-century or more.

Elsewhere the investigation and planning of water resource development proceeded along anticipated lines. Each succeeding year, however, emphasizes that investigation and planning are becoming more and more involved. During the first few decades of water development in the West, the inexpensive, easily developed projects were almost completely exhausted largely by privately financed development. The remaining potentials are, in the main, long-range basin developments of exceeding complexity which only the Federal Government has the ability to finance. A reduction in the funds appropriated for the planning program was made by the Congress in fiscal year 1948, and this reduced program was necessarily continued through fiscal year 1949 not only because of lack of ample funds but because of personnel and administrative restrictions placed on the Bureau by the Congress. Good progress was made on those investigations which could be financed during the year.

Comprehensive Basin Survey Reports

The most significant development in basin planning during the fiscal year was the coordination of the plans of the Bureau of Reclamation and of the Corps of Engineers for the comprehensive development of the Columbia River Basin, formalized by the "Agreement on Principles and Responsibilities for the Comprehensive Plan of Development—Columbia River Basin" signed on April 11, 1949, by the Secretary of the Interior and the Commissioner of Reclamation and by the Secretary of the Army and the Chief of Engineers. At the end of the year there was pending before the Congress legislation which would authorize a program to develop water and related resources of the Columbia River Basin in accordance with this agreement and with the recommendations of the "308 Review Report" of the Corps of Engineers, Department of the Army, and the "Report on Comprehensive Plan of Development of the Water and Related Resources of the Columbia River Basin" of the Bureau of Reclamation, Department of the Interior. The two reports supplement each other. Together these reports contain both long-range plans for the ultimate complete control and conservation of the basin's water resources, and recommendations for authorization of an immediate program of construction as the next step towards full development. The plans also provide for the integration of related programs of land and other resource improvements that are the primary responsibilities of other Federal and State agencies.

At the end of the fiscal year the report on the Central Valley Basin was under review by the Bureau of the Budget. Later, upon completion of this review, the report was transmitted to the Congress.

New Project Authorized

A project planning report was completed on the Solano County project in California. The project was authorized for construction by a finding of feasibility by the Secretary of the Interior. Also, the enlargement of the power plant at Grand Coulee Dam of the Columbia Basin project in Washington to include additional power units R–7, R–8, and R–9 was authorized by a finding of feasibility by the Secretary in a planning report.

Other Project Planning Reports

Project planning reports on The Dalles project, west unit in Oregon and the central Arizona project in Arizona, New Mexico, and Utah were submitted to the Congress by the Secretary with recommendations for favorable action on authorization of the projects. Reports on the Snowflake and Chino Valley projects in Arizona were forwarded to the Congress also, but without recommendation for authorization at this time. A similar report on the Emery County project in Utah was forwarded to the President.

At the end of the fiscal year, reports on the Lyman project in Wyoming, the Vermejo project in New Mexico and the Big Creek project in Texas, were under review by the affected States and other agencies.

Supplemental reports supporting the findings in the Bureau's report on the Columbia River Basin were prepared on the following projects which are proposed for authorization in the next step in the development of the basin:

Bitterroot Valley project, Mont.
Cambridge Bench project, Idaho.
Canby project, Oreg.
Council project, Idaho.
Crooked River project, Oreg.
Hells Canyon project, Idaho, Oreg.
Mountain Home project, Idaho.
Upper Star Valley project, Wyoming, Idaho.
Vale project, Bully Creek extension, Oreg.

River Compacts

A second important development in basin planning was the consummation of a compact between the States on the use of the waters of the Upper Colorado River. This compact entered into by the States of Colorado, Utah, New Mexico, Wyoming, and Arizona was approved by the President on May 6, 1949, and became Public Law 37 of the Eighty-first Congress. For years the lack of this Compact prevented the formulation of the comprehensive plan for the complete and efficient utilization of the waters of the Upper Colorado River. With the situation with respect to water rights thus clarified, it is now possible to proceed with the planning for the comprehensive development of this basin.

A compact between the States of Colorado and Kansas on the Arkansas River was completed and was approved as Public Law 82, Eighty-first Congress, and another compact on the Pecos River was completed by the States of New Mexico and Texas and approved as Public Law 91, Eighty-first Congress.

Alaska Investigations

In the appropriation act for fiscal year 1949, the Congress made an initial appropriation of $150,000 to the Bureau of Reclamation for investigations in Alaska relating to water power resources as a basis for legislation. Field investigations were started immediately and the Bureau completed a report on the Eklutna project which was transmitted to the President. It also made a general preliminary reconnaissance and report on the water resources of the Territory of Alaska. The Bureau is completing another report on the Lake Dorothy project, but so far only the surface has been scratched in investigating the possibilities of water resources development in the Territory.

The reconnaisance report points out that there has been virtually no organized effort on the part of any agency, public or private, to develop or stimulate expansion of industry, community life and agriculture in Alaska. This report reveals that there is a need and that there are vast opportunities for development in the Territory. For example, although only the major streams have been reconnoitered, already the Bureau's engineers have found hydroelectric power sites which could produce nearly 50 billion kilowatt-hours of energy annually. This is equal to nearly one-fifth of the entire electric power production by utilities in the United States last year.

Development of the natural resources of Alaska is essential. It will provide impetus for the industrial expansion and settlement of Alaska and in the ultimate sense, for the defense of the Territory by the prudent development of power, irrigation, and drainage projects. However, before a public works program of any size could go ahead in Alaska, considerable investigation work will have to be undertaken and completed.

Hydrology

In addition to the normal hydrologic studies required for planning and operation of projects the Bureau of Reclamation participated with other Federal agencies through the Federal Inter-Agency River Basin Committee in publishing a revised edition of river basin maps showing hydrologic installations in the United States, an inventory of sediment sampling stations in the United States and quality of water stations in the 17 western States and the Proceedings of the Federal Inter-Agency Sedimentation Conference.

Sedimentation studies were made in connection with specific investigations, particularly in the Middle Loup River Basin in Nebraska, the Colorado River Basin in Arizona, Colorado and Utah; the Angostura unit and the Moorhead unit of the Missouri River Basin project, the North Platte project and the Lower Platte River Basin. Sedimentation surveys were made of Guernsey, Altus, Tongue, Buffalo Bill, and Mason Reservoirs and Sheridan County Lake. The survey of Lake Mead in cooperation with the Geological Survey and the Navy was completed.

These surveys provided valuable information needed to develop the means for attaining maximum efficiency in the operation of projects concerned and to aid in preparation of plans for projected work.

In the instance of Guernsey Reservoir on North Platte River, Wyo., for example, the survey disclosed that the storage capacity of the reservoir was reduced 33.41 percent by sedimentation representing the loss of 24,660 acre-feet, which at $25.48 per acre-foot of storage capacity means a loss of $628,336.80 against an investment of $1,881,036, or about 30 percent. For Tongue Reservoir on the Tongue River, Wyo., the survey disclosed that sedimentation had reduced storage capacity 4.2 percent representing a loss of 3,071 acre-feet, which at $17.93 per acre-foot of storage capacity means a loss of $55,000 against an investment of $1,300,000 or in excess of 4 percent.

The research being conducted by the Army, Navy, and Weather Bureau on artificial precipitation was studied by the Bureau of Reclamation. Liaison on this work with those agencies was established enabling the Bureau to keep abreast of the research of those agencies, and to be advised on the work to the extent that it may effect western water supplies.

International Investigations

As a result of negotiations between Canada and the United States, the two governments jointly sent a reference to the International Joint Commission requesting that a study and advisory findings be made of the present and future uses, and apportionments between the two countries, of certain international streams between the continental divide on the west to and including the Red River of the North on the east.

The International Engineering Boards with their Field Engineering Committee, which included representatives of the Bureau of Reclamation, conducted field studies of available water supplies, the present water uses, and potential future water uses in the vicinity of the international boundary. These determinations are required under the reference as one basis upon which an apportionment between the two countries of the waters under the reference may be recommended.

PROGRAMS AND FINANCE

New Accounting System

After an exhaustive inquiry by the Congress, a Senate Committee emphasized the importance of an early revision of the Bureau's accounting system and related procedures, and instructed the Comptroller General of the United States to work out with the Secretary of the Interior an improvement of the Bureau's accounting system. In accordance with these instructions, representatives of the Bureau of Reclamation and the General Accounting Office have revised the Bureau's accounting system and related procedures.

The Bureau of Reclamation as a governmental agency is required to keep accounts to meet the accounting and reporting requirements of the Congress, the General Accounting Office, the Treasury, and the Bureau of the Budget. As a producer and distributor of electric power, it is also required by law to keep accounts to meet the accounting and reporting requirements of the Federal Power Commission, which include annual financial statements covering each year's operations of all power projects.

As distinguished from the statutory and regulatory requirements discussed above, other important purposes are:

To provide control of expenditures and application of funds for all activities through a coordinated system of accounting, programing, and budgetary reports.

To provide standard and uniform financial statements and reports to summarize the information which is required regularly by the Bureau's administrators for managerial purposes.

To provide for the recording of financial information in a consistent and uniform manner to make possible the compilation of data in such form as to be comparable with similar data for other periods and other projects.

To facilitate the determination of fidelity of persons administering public funds and properties.

Most of the principles used in commercial accounting are incorporated in the Bureau's system of accounts. The Bureau, as a governmental agency, is financed from appropriated funds and is required also to use many of the accounting principles developed for Government, particularly those that relate to budgetary procedures. Certain other principles that are peculiar to the Bureau stem from reclamation laws. The following are essential principles of the system:

The project is considered as the "accounting entity" or the level of operation for the maintenance of the books of accounts. Each project is considered as a basic unit and accounts for its assets, liabilities, income, expenses, the amount appropriated to the project, and the investment of the Government and facility users.

A decentralized system of accounting has been established which results in independent accounts being kept by each project. The control of funds is provided by means of branch office accounts maintained in the Commissioner's office and regional offices.

Properties are accounted for at original cost. Cost accounts for operation and maintenance are on an "applied" or "consumed" basis. Elements of such costs are assigned in the accounting period to which such costs are applicable regardless of the sources of such charges or the time when obligations are incurred or expenditures made.

A system of budgetary control is integrated with the general ledger accounts by the use of subaccounts and special accounting procedures. The budgetary accounts reflect the unliquidated obligations, accrued expenditures, and the unobligated balances of appropriated funds.

The classification of accounts is uniform for programing, budgeting, accounting, and subsequent reporting.

Expenditures are accounted for on the accrual basis, i. e., expenditures are recorded in the allotment accounts when work or services are performed of materials and property received, regardless of whether the vouchers for such items have been paid.

The system of accounts effectively distinguishes between capital and expense.

The following accounts have already been incorporated in the Bureau's new accounting system: General ledger accounts, plant in service accounts, construction work in progress accounts, allotment ledger accounts, electric operating income and expense accounts, and irrigation operation and maintenance accounts.

The general ledger accounts are the basis of the new accounting system, and include all of the control accounts required for the preparation of balance sheets and supporting schedules. The general ledger accounts are so designed that any type of appropriation can be accounted for irrespective of whether the money is to be spent for construction, investigations, operation and maintenance, or other type of activities. Fund control accounts are provided which interlock all offices (project, regional and Washington). These are termed reciprocal accounts and conform to accepted principles of branch-office accounting. The following types of general ledger accounts have been prescribed:

The Commissioner's fund-control accounts control the distribution of appropriated funds and repayments (refunds and reimbursements). A record is kept of all unappropriated funds administered by the Bureau of Reclamation. The accounts also provide the controls which are necessary with the Treasury Department and the Chief Disbursing Officer. The Commissioner allocates the appropriated funds to the various regions for allotment by them to the projects and/or activities. Funds for disbursements are transferred within the amounts allocated to the project and regional offices.

The regional fund control accounts control the distribution of allocated funds which are allotted to the projects and/or activities. The accounts also reflect any unfunded balances due the projects under any appropriation or allotment. The Commissioner's Office of Programs and Finance also maintains regional-type accounts for salaries and expenses, centralized project activities, investigations, and all other Bureau-wide appropriations except Missouri River Basin, rehabilitation and betterment, and the emergency fund.

Several types of general ledger accounts have been prescribed for the projects or Bureau activities, as follows: Project proprietary and fund accounts (for construction and operation and maintenance activities), Commissioner's Washington and Denver Offices and regional offices financed from direct salaries and expenses appropriation, Commissioner's Denver offices financed from transfers to the salaries and expenses appropriation, centralized project activities in regional offices, and investigations. It was considered necessary to prescribe individual types of accounts for projects and activities because the project is the accounting entity. Each accounts for its assets, liabilities, obligations and expenditures as well as reflects the Government's investment, income and expenses, and its general financial condition.

Several groups of subsidiary accounts are required which furnish detailed information. The essential accounts prescribed are: Plant in service accounts: Multipurpose plant, irrigation plant, electric plant, municipal water, other plant; construction work in progress (cost accounts); clearing accounts; allotment accounts; operating income and expense accounts—electric; operating income and expense accounts—irrigation; and other.

Classification of expenditures (on an accrual basis) between capital and expense is important because it has a vital bearing on the financial statements, and eventually influences charges for water and power. Accordingly, plant and property acquired, as well as additions and betterments, whether by construction or purchase and regardless of the source of funds are capitalized at actual cost to the Government and classified to the appropriate plant in service accounts on the basis of the physical characteristics.

Reclamation laws require that the investment in a project be allocated to the various purposes or functions authorized to be carried on by the project. Such allocations are necessary for rate-making purposes, establishing repayment contracts, determining interest payable to the Government on power facilities, pay-out schedules and for the determination of the total reimbursable and nonreimbursable costs of the project.

To assure conformance of work in progress with the Commissioner's approved program and the intent of the Congress in appropriating funds, subsidiary construction cost accounts and a work-order system have been prescribed to accumulate cost data by identified and classes of properties. Control is exercised over construction expenditures through the work-order system as major changes in the program must be approved by the Commissioner of the Bureau.

Clearing accounts have been prescribed to accomplish two important purposes: (1) to accumulate costs by activities which benefit several functions, features or units of a project and which must be distributed on the basis of benefits received by each, and (2) to accumulate costs which cannot be assigned to the appropriate function at the time the expenditure is incurred.

The allotment accounts are designed and maintained for one basic purpose, which is to make certain that the Bureau conforms with the Antideficiency Act. Departments are prohibited from incurring obligations and spending more than has been appropriated. All transactions involving expenditures or obligating the Bureau for future expenditures are recorded on a current basis. The unencumbered and unobligated allotments, unliquidated obligations, and expended and unexpended balances of the allotments are also shown.

The operating income and expense accounts, electric, are designed to show the amount of money earned by the projects from furnishing electricity and services incidental thereto. The expense accounts show the detailed cost of furnishing these services. The classification of accounts conforms to the system prescribed by the Federal Power Commission.

The operating income and expense accounts, irrigation, are designed to show the different types of income from furnishing water under contracts and miscellaneous receipts incidental to irrigation operations. The expense accounts show the detailed cost of furnishing the irrigation water. The classification of accounts is set up on the same general principal as is provided for under electric-operating expenses.

Separate accounts are established for: (1) operation and maintenance charges financed by advances: (2) operations under section 9 (e) of the 1939 Reclamation Law where the annual rates for service is to return the cost of operation and maintenance and the construction costs over the period of the water contracts; and (3) for operations paid from Reclamation Fund appropriations and reimbursed by water users.

Other subsidiary accounts are established for such items as repayment contracts, contributions in aid of construction, and special deposits where the detail work involved justifies subsidiary accounts.

All financial and operating statements, including the fund statements, are prepared from the general ledger and related subsidiary accounts. The basic financial statements and reports which will be submitted either monthly, semiannually, or annually are: Balance sheet, income and expense statements, construction work in progress statement, plant in service statements, report on status of appropriations, analysis of operating surplus or deficit, and sources and application of funds statement. These statements constitute the source of all financial data. Any other financial information shall be certified correct by the regional programs and finance officers.

The new accounting system has been completely installed in all projects of the Bureau of Reclamation as of June 30, 1949, with the exception of the work-order system, which has been partially installed on all major construction projects.

Manualization of Procedures

During the fiscal year, a basic system was developed to control the programing, budgeting, accounting, and reporting of Bureau activities. The primary emphasis has been on construction activities; and, although much work remains to be done on many of the detail elements of the system, and on its complete application to investigations, operation and maintenance, rehabilitation and betterment, and other substantive activities, the essential system is now in operation.

During the early months of the year, key personnel of the Office of Programs and Finance, in collaboration with representatives of the General Accounting Office, the Bureau of the Budget, and the Treasury Department, conducted a series of trial installations of a new system in several field offices in region 1. The offices were carefully selected to provide a representative cross-section of all types of Bureau activities.

The new program system covers control schedules, cost schedules, budget documents, and a system of program reports which reconcile with the financial records and accounts and provide complete integration of the budget documents with the program schedule and reports. A preliminary draft of procedures for construction activities has been issued and will be used as a prototype for extending the system to all other activities.

Major segments of the accounting system have been printed in final Manual form which includes the completely integrated system of general ledger accounts, the procedure to control funds at all organizational levels, the allotment accounting system which will insure against the overobligation of funds and appropriations, integrated billing and collection procedure, and a complete system of financial statements and reports based on the new general ledger accounts.

With the co-operation of the Treasury Department, a modified disbursing procedure was developed, which eliminates the transmission of bulky documents to the Treasury Disbursing Offices, but retains all elements necessary for a thorough audit of disbursements by the General Accounting Office.

During the development of the new system, more than 50 forms and reports have been eliminated, and it is anticipated that at least 200 more will be eliminated by the time the new system is completed.

At the end of the year, work was in progress on the development of procurement and property accounting procedures, a simplified pay-roll and retirement accounting procedure, and the refinement and manualization of all of the program, budget, and reporting procedures.

Program Coordination

Programing operations which provide for the proper coordination of all phases of the Bureau's activities into a sound construction program and the maintenance of the necessary administrative control to keep the program advancing along a prescribed path toward stated objectives was firmly entrenched during the year.

By the beginning of the fiscal year, a coordinated program and finance organization had been established throughout the Bureau and programing procedures, built up primarily around the control schedule, PF–2, and the annual project schedule, PF–3, had been promulgated and placed in service. While these procedures and documents have proved extremely valuable, the programing personnel has devoted considerable effort during the fiscal year to refining and improving those procedures in the light of actual experience in their preparation and use for the development and control of the project programs and for budget presentations. The instructions for the preparation of the various programing schedules have been revised to achieve greater uniformity in presentation, greater flexibility in programing so as to accommodate changing conditions and budgetary requirements, and more adequate presentation of the project content and scope. In addition, special attention has been given to coordinating the programing procedures and operations with the revised accounting system of the Bureau.

Coordination of programing and budgeting has been achieved by avoidance of hairsplitting definitions of functions and jurisdiction

TABLE 12.—*Bureau of Reclamation schedule of advance construction program, fiscal years 1950–56—authorized projects*

Project and State	Total estimated cost	Obligations June 30, 1949	Program of obligations							
			1950	1951	1952	1953	1954	1955	1956	Balance to complete
All-American, Ariz.-Calif	$76, 993, 213	$52, 094, 635	$6, 325, 251	$4, 662, 000	$20, 000	$20, 000	$20, 000	$20, 000	$6, 784	$13, 824, 543
Austin, W. C., Okla	13, 206, 000	12, 146, 315	328, 205	263, 000	134, 257	139, 000	139, 000	112, 725		−56, 502
Belle Fourche, S. Dak	4, 658, 884	4, 638, 180	20, 704							
Boise-Anderson Ranch, Idaho	30, 945, 000	27, 982, 483	2, 126, 185	836, 332						
Boise-Drainage, Idaho	160, 000	32, 435	5, 000							122, 565
Boise-Payette, Idaho	17, 173, 000	14, 432, 610	2, 552, 253	354, 375						−166, 238
Boulder Canyon, Ariz.-Nev	173, 900, 000	151, 355, 617	6, 621, 782	7, 000, 000	5, 000, 000	2, 600, 000	1, 100, 000	221, 021		1, 580
Buffalo Rapids, First Division, Mont	2, 735, 000	1, 869, 453	73, 254	190, 316	295, 000	225, 000	81, 977			
Buffalo Rapids, Second Division, Mont	2, 638, 000	1, 910, 431	157, 827	73, 000	173, 000	138, 000	138, 000	47, 742		
Central Valley, Calif	577, 645, 000	266, 269, 886	[1] 60, 706, 222	59, 805, 784	39, 563, 184	53, 686, 495	46, 830, 034	30, 010, 190	11, 756, 905	9, 801, 000
Colorado-Big Thompson, Colo	150, 503, 000	76, 493, 134	20, 973, 503	22, 000, 000	17, 351, 250	8, 600, 000				5, 085, 113
Colorado River Front Work and Levee System, Ariz.-Calif.-Nev	18, 980, 000	3, 344, 241	951, 460	2, 025, 000	6, 175, 000	5, 075, 000	2, 600, 000			−1, 190, 701
Columbia Basin, Wash	773, 339, 000	298, 914, 434	72, 020, 341	55, 500, 000	34, 200, 000	38, 700, 000	32, 000, 000	27, 100, 000	23, 200, 000	191, 704, 225
Davis Dam, Ariz.-Nev	114, 438, 000	60, 650, 984	37, 362, 539	15, 722, 640	530, 000	90, 000	83, 911			−2, 074
Deschutes-Arnold irrigation district, Oreg	207, 150	151, 209	38, 941	17, 000						
Deschutes-Grants Pass irrigation district, Oreg	102, 200	2, 200	83, 800	16, 200						
Deschutes-North unit, Oreg	12, 850, 000	11, 470, 308	265, 648	500, 000	151, 000	34, 000	25, 000	25, 000	25, 000	354, 044
Deschutes-Ochoco Dam, Oreg	1, 076, 000	118, 466	947, 534	10, 000						
Eden, Wyo	4, 828, 000	363, 137	200, 436	1, 416, 821	1, 688, 000	903, 507	256, 099			
Fort Peck, Mont	16, 250, 000	4, 603, 151	2, 931, 838	1, 743, 000	1, 577, 000	1, 125, 000	522, 000	809, 000	1, 080, 000	1, 859, 011
Fort Sumner, N. Mex	2, 464, 000	69, 000	750, 000	1, 681, 000	64, 000					−100, 000
Gila, Ariz	53, 560, 235	14, 492, 630	5, 993, 623	7, 308, 000	7, 947, 000	5, 088, 000	2, 727, 000	2, 727, 000	2, 292, 000	4, 984, 982
Grand Valley, Colo	5, 243, 840	4, 992, 959	1, 581	111, 035	138, 265					
Hungry Horse, Mont	108, 800, 000	19, 216, 769	22, 521, 472	31, 000, 000	20, 400, 000	12, 200, 000	3, 461, 759			
Kendrick, Wyo	25, 000, 000	20, 442, 207	1, 741, 041	1, 000, 000	850, 000	536, 260	200, 000	230, 492		
Kern River, Calif	125, 000	6, 000	8, 700	18, 000	57, 000	35, 300				
Kings River, Calif	285, 000	206, 231	31, 600	28, 531	18, 638					
Klamath, Oreg.-Calif	17, 782, 298	11, 894, 822	1, 309, 086	1, 000, 000	1, 092, 390	1, 560, 000	800, 000	126, 000		
Lewiston Orchards, Idaho	2, 500, 000	1, 997, 345	257, 029	245, 626						
Milk River-Fresno Dam, Mont	2, 000, 000	1, 746, 200	64, 240	40, 800						148, 760
Minidoka, Idaho	28, 153, 000	23, 916, 568	457, 704	419, 515	3, 359, 213					
Missouri River Basin (various)	2, 706, 032, 930	109, 179, 883	87, 819, 019	127, 453, 289	158, 755, 949	215, 841, 144	240, 161, 230	214, 858, 550	181, 244, 413	1, 370, 719, 453
Ogden River, Utah	4, 761, 267	4, 481, 575	279, 692							
Owyhee, Oreg.-Idaho	18, 837, 476	18, 807, 613	29, 863							
Palisades, Idaho	76, 601, 000	2, 442, 267	3, 145, 202	8, 300, 000	15, 100, 000	19, 250, 000	17, 200, 000	6, 200, 000	1, 300, 000	3, 663, 531
Paonia, Colo	4, 747, 000	646, 843	559, 495	1, 249, 658	1, 426, 604	864, 400				

[1] Includes $784,700 contractors claims not included in total estimated cost.

TABLE 12.—*Bureau of Reclamation schedule of advance construction program, fiscal years 1950–56—authorized projects*—Continued

Project and State	Total estimated cost	Obligations June 30, 1949	Program of obligations							
			1950	1951	1952	1953	1954	1955	1956	Balance to complete
Parker Dam Power, Ariz.-Calif	$23, 806, 500	$23, 210, 823	$641, 175							−$45, 498
Preston Bench, Idaho	453, 000	428, 688	24, 312							
Provo River, Utah	28, 050, 000	18, 607, 871	4, 370, 304	$2, 151, 000	$1, 552, 275	$1, 368, 550				
Rathdrum Prairie-Hayden Lake, Idaho	117, 625	113, 990	3, 635							
Rehabilitation and betterment	37, 780, 900	1, 263, 240	2, 736, 760	5, 000, 000	4, 919, 500	2, 815, 000	$2, 175, 400	$1, 500, 000	$1, 431, 400	15, 939, 600
Rio Grande, N. Mex.-Tex	14, 178, 000	12, 252, 442	285, 450	1, 091, 000	548, 550					558
Riverton, Wyo	21, 813, 403	13, 512, 106	2, 526, 116	3, 658, 000	2, 067, 000	526, 000	45, 734	−521, 553		
San Luis Valley, Colo	45, 146, 000	1, 189, 058	1, 671, 352	1, 839, 000	685, 500	1, 914, 000	6, 689, 000	10, 289, 000	9, 401, 000	11, 468, 090
Santa Barbara County, Calif	34, 189, 000	658, 767	4, 125, 039	10, 960, 000	10, 533, 716	6, 563, 000	1, 348, 478			
Shoshone, Wyo	16, 851, 705	13, 259, 945	780, 162	358, 000	1, 507, 000	150, 000	239, 000	295, 000	220, 208	42, 390
Solano County, Calif	45, 577, 000	0	100, 000	1, 250, 000	4, 550, 000	12, 315, 000	13, 610, 000	8, 780, 000	4, 972, 000	
Sun River (Greenfields), Mont	9, 700, 000	9, 506, 886	42, 639	54, 000						96, 475
Tucumcari, N. Mex	16, 730, 000	15, 166, 841	605, 704	218, 000	218, 000	106, 601				414, 854
Valley Gravity, Tex	126, 552, 000	1, 398, 269	83, 000	9, 000	775, 000	27, 625, 000	26, 778, 000	26, 032, 000	22, 691, 000	21, 160, 731
Water conservation and utilization (various)	11, 988, 665	11, 589, 583	387, 904	11, 178						
Weber Basin (initial unit), Utah	69, 534, 000	331, 961	334, 100	1, 000, 000	5, 899, 939	8, 550, 000	7, 177, 000	6, 900, 000	7, 125, 000	32, 216, 000
Yakima-Kennewick, Wash	10, 736, 000	674, 000	50, 000	1, 910, 000	3, 115, 000	3, 114, 000	1, 873, 000			
Yakima-Roza, Wash	22, 868, 000	20, 171, 646	466, 873	1, 030, 000	1, 013, 000					186, 481
Total	5, 585, 692, 291	1, 366, 718, 337	[1] 358, 896, 595	382, 530, 100	353, 451, 230	431, 758, 257	408, 281, 622	335, 862, 167	266, 745, 710	1, 682, 232, 973

[1] Includes $784,700 contractors claims not included in total estimated cost.

Project and State	Rate of power development—kw. (in thousands)										Rate of irrigation development—acres (in thousands)								
	Existing June 30, 1949	1950	1951	1952	1953	1954	1955	1956	Estimated additional		Existing June 30, 1949	1950	1951	1952	1953	1954	1955	1956	Estimated additional
All-American, Ariz.-Calif										F	3.0	32.0	24.3						
										S	430.0	12.0	9.0						
Austin, W. C., Okla										F									
										S	50.0								
Belle Fourche, S. Dak										F									
										S									
Boise-Anderson Ranch, Idaho		13.5	13.5							F									
										S	100.0	200.0							
Boise-Drainage, Idaho										F									
										S									
Boise-Payette, Idaho										F	46.7	6.0							
										S									
Boulder Canyon, Ariz.-Nev	1,034.8			165.0	50.0	82.5				F									
										S									
Buffalo Rapids, First Division, Mont										F	14.2	.6	.9						
										S									
Buffalo Rapids, Second Division, Mont										F	5.7	3.5	2.4						
										S									
Central Valley, Calif	375.0	75.0				160.0	120.0	80.0	45.0	F	38.5		4.5	45.0	80.0	80.0	80.0	61.0	153.0
										S	51.5	14.0	216.5	90.0	40.0	30.0	30.0	29.0	
Colorado-Big Thompson, Colo	21.6	53.1			102.7					F									
										S	19.0	5.0	54.0	408.0	147.0	85.0			
Colorado River Front Work and Levee System, Ariz.-Calif.-Nev										F									
										S									
Columbia Basin, Wash	1,100.0	334.0	324.0	216.0						F	5.6	1.2		87.0	68.6	69.7	86.2	74.7	640.0
										S									
Davis Dam, Ariz.-Nev			225.0							F									
										S									
Deschutes-Arnold irrigation district, Oreg										F									
										S									
Deschutes-Grants Pass irrigation district, Oreg										F									
										S									
Deschutes-North unit, Oreg	1.5									F	50.0								
										S	46.0								
Deschutes-Ochoco Dam, Oreg										F									
										S									
Eden, Wyo										F	9.0				11.0				
										S									

F = Full supply.
S = Supplemental supply.

TABLE 12.—*Bureau of Reclamation schedule of advance construction program, fiscal years 1950–66—authorized projects*—Continued

Project and State	Rate of power development—kw. (in thousands)										Rate of irrigation development—acres (in thousands)								
	Existing June 30, 1949	1950	1951	1952	1953	1954	1955	1956	Estimated additional		Existing June 30, 1949	1950	1951	1952	1953	1954	1955	1956	Estimated additional
Fort Peck, Mont	50.0		35.0							F									
										S									
Fort Sumner, N. Mex										F									
										S			6.5						
Gila, Ariz										F	20.0			4.0	12.1	13.0	10.0	5.0	30.0
										S	1.0	7.0		7.0					6.0
Grand Valley, Colo										F	38.5			1.1					
										S									
Hungry Horse, Mont					142.5	142.5				F									
										S									
Kendrick, Wyo	32.4									F	6.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
										S									
Kern River, Calif										F									
										S									
Kings River, Calif										F									
										S									
Klamath, Oreg.-Calif										F	148.2							6.0	23.8
										S	30.0								
Lewiston Orchards, Idaho										F									
										S									
Milk River-Fresno Dam, Mont										F									
										S									
Minidoka, Idaho										F	318.7								
										S	675.0								
Missouri River Basin (various)		24.0	12.0	15.0		70.0	125.9	13.0	793.3	F	2.2	4.0	19.7	58.1	129.5	122.2	120.6	126.9	4,593.5
										S	2.6			17.1	54.3	24.3	12.5	16.6	959.5
Ogden River, Utah										F	4.0								
										S	16.6								
Owyhee, Oreg.-Idaho										F	103.5								
										S									
Palisades, Idaho						22.5	45.0		45.0	F									
										S							650.0		
Paonia, Colo										F			0.5	1.5					
										S			5.0	7.8					
Parker Dam Power, Ariz.-Calif	120.0									F									
										S									
Preston Bench, Idaho										F		4.1							
										S									
										F									

Provo River, Utah										S		46.2	6.0	4.0					
										F									
Rathdrum Prairie-Hayden Lake, Idaho										S									
										F									
Rehabilitation and betterment										S									
										F									
Rio Grande, N. Mex.-Tex	24.3									S									
										F	56.0	7.0	7.2	11.8	16.0	3.0			
Riverton, Wyo	1.6									S									
										F									
San Luis Valley, Colo										S					73.9	12.3			469.8
										F									
Santa Barbara County, Calif										S						29.7			
										F	107.5				7.5				
Shoshone, Wyo	10.6									S									
										F							22.0	4.0	51.6
Solano County, Calif										S							5.0		
										F	97.0								
Sun River (Greenfields), Mont										S									
										F	30.0	13.4							
Tucumcari, N. Mex										S									
										F								75.4	55.3
Valley Gravity, Tex										S								552.0	
										F	22.5	5.1	.6	.2	.1				
Water conservation and utilization (various)										S	52.2	2.9							
										F						4.0		3.0	63.4
Weber Basin (initial unit), Utah									6.0	S						6.0		4.0	20.0
										F	4.0				5.0	12.0			
Yakima-Kennewick, Wash						12.0				S									
										F	47.1	24.9							
Yakima-Roza, Wash					10.0					S									
Total	2,771.8	499.6	609.5	396.0	305.2	278.0	290.9	93.0	889.3	F	1,139.4	103.8	32.7	209.6	331.8	305.9	320.8	358.0	5,610.6
										S	1,512.4	287.1	297.0	532.0	315.2	187.3	697.5	601.6	1,455.3

F = Full supply.
S = Supplemental supply.

and by maximizing the interchange of information between the two processes. While the programing precedes budgeting in point of time and the processes have independent courses, requirements and time-scheduling, a close working relationship was maintained between the two functions to achieve a well coordinated operation for the development of sound realistic programs and the translation, in a limited amount of time, of those programs into budgetary forms.

The financing and programing problems arising from the continuation of construction on the remaining nearly completed Water Conservation and Utilization projects was examined. Completion of some of these projects requires substantial additional expenditures and the remaining construction cannot be undertaken without additional authority, either because of provisions contained in the basic authorization relating to the total cost or because of the disproportionate repayment arrangements brought about by increased costs.

Appropriations

The regular and supplemental appropriations for 1949 of $266,763,964 were the largest ever received by the Bureau. With an unused balance of $32,318,077 from the previous year, the money available for Reclamation totaled $298,982,041—the largest annual program in the history of the Bureau.

Due in large part to unexpected delays in the passage of supplemental appropriations amounting to over 20 million dollars (such appropriations being made available in the latter part of the fourth quarter), at the end of the fiscal year there was an unobligated 35½ million dollars carried over into fiscal year 1950. On the same basis, obligations for fiscal year 1949 totaled 264.5 million dollars, representing 88.5 percent of work programed in 1949 compared with 88 percent accomplished in fiscal year 1948 and 82 percent for fiscal year 1947.

Certain restrictions in the 1949 Appropriation Act, as in 1948, handicapped the Bureau during the year in its construction program. One restriction was the limitation placed on construction work by Government forces ("force account" work), whereby not to exceed 8 percent of the appropriation of any project could be so used. Although most Reclamation work is done by contract with private construction firms who build according to Bureau design and under the supervision of Bureau engineers, some activities are outside the general contracting field, risks are great, and contractors either are not interested or feel that they must protect themselves by higher bids.

Another restriction was a limitation during the greater part of the fiscal year of $7,800,000 on design work for the projects performed by the Bureau's central design office at Denver. While this limitation was increased to $9,250,000 in the last quarter of the year, it still had the effect of limiting service at a time when construction work was being accelerated. It was necessary to continue a large part of the design work in the project offices where difficulty to recruit and retain experienced personnel was encountered.

A $50,000 restriction upon expenditures for General Offices public informational services again materially impaired the ability of the Bureau to respond to increased requests for information from the Congress, the press, and the public, resulting from added interest caused by the expanded construction program. The burden of this work fell to a great extent on an overtaxed technical staff and on officers responsible for the prosecution of the construction program, hampering performance of regular work for which they were responsible.

Restrictions limiting the amount which could be expended for personal services of all kinds to $48,000,000 and the number of employees in grades CAF–9 and P–3 and above to 3,500 were important factors in the Bureau's inability fully to execute the program scheduled. The limitation for all personal services was increased to $54,500,000 in the last quarter of the year, but here again the relief came too late to have any real salutary effect on the Bureau's program, and as a result the unobligated balance carried over into 1950 was considerably increased.

Finally, a restrictive clause setting forth the qualifications required for persons holding the offices of Commissioner, Assistant Commissioner, and Regional Director resulted in the Commissioner and the Director of Region 2 serving without pay from January 31 to June 30. Request for a supplemental appropriation to cover the salaries of these officials thus withheld has been submitted.

Reclamation construction work in the West was originally financed from the Reclamation fund, which consisted of money received from the sale of public land supplemented by small loans from the Treasury and, later, oil royalties. In 1916, Congress began to make annual appropriations out of the fund for the work and the Bureau was required to budget its needs for the coming fiscal year's operations and justify the appropriation requested in the same manner as all other Government agencies.

Funds made available to the Bureau from its inception to date are shown in the following table. From 1902 to 1915 the amounts shown were authorized by Secretarial action. Subsequent amounts were appropriated by Congress.

TABLE 13.—*Allotments from Reclamation fund, 1902–15, appropriations from Reclamation and general funds, 1916–49, and emergency fund allocations (NIRA, PWA, and ERA)*

Fiscal year	Allotments from Reclamation fund	Appropriations (including revenue authorizations)	Emergency fund allocations	Total
1902	[1] $855,000			[1] $855,000
1903				
1904	[1] 18,200,000			[1] 18,200,000
1905	[1] 8,758,000			[1] 8,758,000
1906	[1] [2] −9,711,173			[1] [2] −9,711,173
1907	[1] 15,211,407	$1,000,000		[1] 16,211,407
1908	[1] 10,011,765			[1] 10,011,765
1909	[1] 10,378,950			[1] 10,378,950
1910	[1] 8,504,050			[1] 8,504,050
1911	24,722,790			24,722,790
1912	7,286,000			7,286,000
1913	6,229,000			6,229,000
1914	9,764,166			9,764,166
1915	11,742,042			11,742,042
1916		13,530,000		13,530,000
1917		8,902,557		8,902,557
1918		8,537,213		8,537,213
1919		9,840,277		9,840,277
1920		7,848,927		7,848,927
1921		9,124,177		9,124,177
1922		20,601,871		20,601,871
1923		15,359,530		15,359,530
1924		12,564,067		12,564,067
1925		13,640,809		13,640,809
1926		12,363,240		12,363,240
1927		7,556,320		7,556,320
1928		12,203,800		12,203,800
1929		14,443,400		14,443,400
1930		8,743,000		8,743,000
1931		20,242,000		20,242,000
1932		22,371,000		22,371,000
1933		25,866,953		25,866,953
1934		11,456,335	$87,205,098	98,661,433
1935		1,176,750	30,523,787	31,700,537
1936		15,438,100	36,883,746	52,321,846
1937		56,444,600	1,646,362	58,090,962
1938		42,417,600	31,089,515	73,507,115
1939		45,410,600	2,376,654	47,787,254
1940		78,165,600	2,715,032	80,880,632
1941		74,533,600	13,514	74,547,114
1942		102,776,031	24,824	102,800,855
1943		91,663,670		91,663,670
1944		41,610,575		41,610,575
1945		27,434,000		27,434,000
1946		120,943,650		120,943,650
1947		119,631,088		119,631,088
1948		143,185,038		143,185,038
1949		266,203,767		266,203,767

[1] Calendar year.

[2] Negative amount reflects partial invalidation of previous allotments.

The amount appropriated, including all supplementals for fiscal year 1949 for each activity, is as follows:

TABLE 14.—*Condensed statement of appropriations, fiscal year 1949, exclusive of trust funds*

Appropriation		Amount
Reclamation fund, special fund:		
Salaries and expenses		$3,860,000
General investigations		3,500,000
Construction [1]		18,250,810
Operation and maintenance—direct appropriation (irrigation)	$1,841,853	
Operation and maintenance—power revenues	6,999,601	
Operation and maintenance, total		8,841,454

[1] In addition, Appropriation Act permits contract authorization of $1,600,000 for Santa Barbara County project, California (Cachuma Unit) and $2,000,000 for Palisades project.

TABLE 14—*Condensed statement of appropriations, fiscal year 1949, exclusive of trust funds—Continued*

Appropriation	Amount
Reclamation fund, special fund:—Continued	
Emergency fund	$1,000,000
Rehabilitation and betterment of existing projects	1,500,000
Total, Reclamation fund, special fund (includes appropriation from power revenues)	36,952,264
General fund:	
Alaskan investigations	150,000
Construction	227,211,700
Total, general fund	227,361,700
Colorado River Dam fund:	
Colorado River development fund (expenditure account)	900,000
Boulder Canyon, operation and maintenance	1,550,000
Colorado River Dam fund, total	2,450,000
Total, general and special funds (includes appropriation from power revenues)	266,763,964

Funds available for appropriation from the Reclamation fund, and actual and estimated appropriations therefrom for fiscal years 1949–51, are shown in the following tabulation:

TABLE 15.—*The Reclamation fund, 1948–50, funds available for appropriation*

Item	Actual 1948	Actual 1949	Estimate 1950
Unappropriated balance brought forward (as of June 30)	$14,173,102	$34,759,576	$41,136,791
Accretions to fund:			
Public land sales	412,654	1,014,906	450,000
Mineral Leasing Act	10,070,710	18,347,297	14,000,000
Potassium royalties and rentals	133,352	17,876	150,000
Federal power licenses	33,134		35,000
Rights-of-way, withdrawn lands	1,417	197	1,000
Income from accretions	10,651,267	19,380,276	14,636,000
Repayment income:			
Construction charges collected	3,258,592	3,481,372	3,500,000
Operation and maintenance collections	513,661	566,961	575,000
Power revenues	29,492,540	15,921,773	17,000,000
Water rentals	425,922	1,410,327	1,500,000
All other (rental from grazing and farming lands, reimbursements, etc.)	1,921,242	2,568,770	2,600,000
Total repayment income	35,611,957	23,949,203	25,175,000
Total available for appropriation	60,436,326	78,089,055	80,947,791
Deduct appropriation or estimate for:			
Salaries and expenses	3,130,000	3,860,000	4,300,000
General investigations	2,000,000	3,500,000	3,700,000
Investigations, Upper Colorado River Basin			500,000
Advance planning			50,000
Construction	13,558,250	18,250,810	20,977,463
Operation and maintenance	6,988,500	8,841,454	11,702,872
Rehabilitation and betterment of existing projects		1,500,000	
Emergency fund		1,000,000	
Total appropriation or estimate	25,676,750	36,952,264	41,230,335
Balance carried forward	34,759,576	41,136,791	39,717,456

Reports

The submission to the Senate and House Appropriations Committees of quarterly reports on the status of funds appropriated for construction was continued during fiscal year 1949, following the pattern developed in the previous year. Similarly, recurring reports continued to be prepared at the project level to reflect current, cumulative, and anticipated contractors' earnings. A modified system of reports, geared to the newly streamlined accounting system of the Bureau, took form as the year progressed. The new reports, aiming particularly at a more immediate comparison of program and progress, serve as a specific instrument in management control. By June 30, most projects had submitted test runs in compliance with revised procedures then approved. Fiscal year 1950 submissions are to be prepared under the modified reports system as progressively developed.

Special monthly tabulations provided a means for close surveillance during the year of prospective year-end carry-over of unobligated funds and of unliquidated obligations. Program attainments could thereby be more accurately gaged and encouraged, and planning emphasis more precisely directed.

In accordance with provisions in the Interior Department Appropriation Act of 1949, the amounts of accrued contractors' earnings retained as hold-backs became unavailable for obligation for any purpose, no matter when payments of such withheld percentages were to be made. To give effect to the legislation, hold-backs were deposited in special accounts.

To meet administrative and operating needs for frequently used, single-source statistical data, a set of four ready-reference books was compiled, consisting of (1) a volume entitled "Bureau of Reclamation Appropriation Acts and Allotments," containing exact copies of all appropriation acts relating to the Bureau from its establishment in 1902 to 1949; (2) a volume entitled "Bureau of Reclamation Project Feasibilities and Authorizations," presenting project findings of feasibility and authorizations for projects during this period; (3) a volume entitled "Bureau of Reclamation Public Notices," consisting of a collection of notices issued; and (4) a volume entitled "Bureau of Reclamation Project Finance Data" in tabular form, exhibiting basic statistical finance data on each project progressed by the Bureau during its existence through fiscal year 1949.

The restrictions imposed by the 1949 Appropriation Act which limited expenditures for personal services to $48,000,000 and the number of personnel in grades P–3, CAF–9, and above to 3,500, was administered by means of allocations, controls, and reports. The dollar limitation necessitated the reduction in personnel from a total of 16,862 full-time employees in July 1948 to a total of 13,002 by January 1949—

a reduction of 3,860 representing 23 percent. This low level of employment continued under the limitation into May 1949. With relief given by the First Deficiency Appropriation Act of 1949 which, among other items, revised the personal-services dollar limitation to exclude Public Law 900 and trust and contributed funds, recovery in total full-time employment in June reached 15,401 at the year end. Throughout the year employment in grades P–3, CAF–9, and above was maintained within the limitation of 3,500 positions in this category.

The consolidated statement by projects of construction cost of irrigation and power works, other items reimbursable with construction, and deductions for fiscal year 1949, similar in presentation to that appearing on pages 88–91 of the 1948 Annual Report of the Secretary, has been omitted pending completion of revision of the Bureau's accounting system.

COMPTROLLER

The Office of the Comptroller continued on an expanded basis the consultative and advisory assistance to the Commissioner and his top staff; the review and approval of proposed accounting procedures and other system elements; and the performance of independent financial audits of Bureau projects, water users' associations, contract settlements, and other features of Bureau operations.

In the field of policy development and advisory assistance, this Office has played a conspicuous role in problems of municipal finance and management, special studies of the interagency agreements, analysis and interpretation of external audit reports, and problems relating to the effect of legislative developments.

The over-all program of water users' audits reflected substantial progress. All urgent requests for audit and advisory assistance adjunctive thereto were filled. This work involved removal of a backlog of several years. Auditing policies and procedures for this activity were improved for more significant results both from a practical and technical standpoint.

In terms of satisfaction of Bureau requirements and Comptroller's office objective, the fiscal year 1949 marked the first really concrete accomplishments in the important program of project financial auditing. Auditors were equipped with specific performance standards and job instructions. Audits of major projects were undertaken for the first time. While intensity of audit activity varied as between regions, at least one project in each region was covered.

The financial audits were adjusted by the installations of the Bureau's new accounting system which were concentrated largely in the 1949 fiscal year. It was considered desirable to audit following account conversions, and since the audit program had been initially constructed around the old account structure, a substantial burden of training and reprogramming was required.

On the basis of more representative evaluation factors provided by this year's performance by the Office of the Comptroller, technical instructions are being amplified, more rigid time performance requirements are being instituted, and organizational changes aimed at maximum accomplishment are being directed.

LEGISLATION

Several bills of far-reaching significance to present and future water and power users on Reclamation projects were introduced in the Congress during the fiscal year. One of the bills of most importance to the Bureau's program to be enacted by the first session of the Eighty-first Congress is Public Law 37 (S. 790), granting the consent of the United States to the Upper Colorado River Basin Compact. The compact makes an equitable division among the States of Arizona, Colorado, New Mexico, Utah, and Wyoming, of the waters of the Colorado River System, the use of which was apportioned to the Upper Basin by the Colorado River Compact of 1922. There was also enacted Public Law 82 (H. R. 4151), granting the consent of the United States to the Arkansas River Compact, which relates to the use of the waters of the Arkansas River by the States of Colorado and Kansas, and Public Law 91 (H. R. 3334), granting the consent of the Congress to the Pecos River Compact, which provides a division of the waters of the Pecos River between New Mexico and Texas. All three measures were reported on favorably by the Department.

Another bill of vital interest to the Bureau to be enacted is Public Law 56 (H. R. 4152), the first omnibus amendatory repayment contract measure to be passed by the Congress. This measure authorizes the execution by the Secretary of the Interior of amendatory repayment contracts negotiated, pursuant to section 7 of the Reclamation Project Act of 1939, with the Bitter Root irrigation district, the Shasta View irrigation district, the Okanogan irrigation district, the Willwood irrigation district, the Uncompahgre Valley Water Users' Association, and the Kittitas reclamation district. There is now pending House bill 5184, which would authorize the Secretary to execute amendatory repayment contracts negotiated under section 7 of the Reclamation Project Act of 1939 with the Belle Fourche irrigation district, the Deaver irrigation district, the Westland irrigation district, the Stanfield irrigation district, the Vale Oregon irrigation district, and the Prosser irrigation district. Favorable action by the Congress on this bill is anticipated.

Public Law 132 (S. 55) provides the necessary authorization to permit the Bureau of Reclamation to complete the construction of the irrigation facilities of the Eden project, Wyoming, as originally authorized by the President on September 18, 1940, as a Great Plains project, with such modifications as the Secretary may find will result in greater engineering and economic feasibility.

The enactment of Public Law 102 (S. 690) authorizes the delivery of water to the Yuma auxiliary project through the irrigation system of the Yuma Mesa division of the Gila project, a reduction in project lands by excluding lands which cannot successfully be irrigated under present conditions, and the effecting of related physical and financial adjustments.

In addition to the public laws set forth above, a number of private bills arising out of Bureau activities were enacted for various purposes.

Several measures introduced in Congress were still pending as of the close of the fiscal year. They are discussed briefly because of their importance, inasmuch as their enactment would make basic changes in the reclamation laws and the Bureau's program. They have received extensive consideration in the Office of the Chief Counsel and other branches of the Bureau.

A measure having greatest interest to the Bureau is House bill 1770, which would provide for certain revisions in section 9 of the Reclamation Project Act of 1939. One objective of this bill is to give statutory recognition to the fact that multipurpose Federal Reclamation projects frequently serve various purposes in addition to those now covered by law (principally, irrigation and the production of hydroelectric power), and to provide that the whole cost of facilities which serve these additional purposes need not be borne by the water users and consumers of electric power. This objective would be achieved by writing into the Reclamation Project Act of 1939 authority to make nonreimbursable allocations of capital and operation and maintenance costs to flood control, navigation, fish and wildlife propagation, recreation, general salinity control, sediment control, the improvement of public transportation, protection of the public health, promotion of the national defense, and the fulfillment of international obligations. Only the first three of these items are now provided for by statute and, as to them, present law covers only allocations of capital costs.

The second objective of the bill is to afford the basis for an improved contract relationship between the Bureau of Reclamation and its irrigation water users. Amendments of section 9 (d) of the Reclamation Project Act of 1939 would (*a*) permit annual repayment installments to vary according to the terms of such formula as the water users and the United States agree upon, (*b*) make it clear that section 8 of the 1902 Reclamation Act applies to section 9 (d) repayment contracts, and (*c*) provide for the transfer of works for care, operation, and maintenance by organizations of water users. Section 9 (e) would be amended to provide (*a*) that the repayment contract rates could be fixed for the entire term of the contract or they could be made to reflect changes in the financial condition of the contracting organization, (*b*) that section 9 (e) contracts would be made specifically subject to section 8 of the 1902 Reclamation Act, (*c*) that such contracts would be renewable, at the option of the contracting organization, on terms and conditions agreed to by the parties, (*d*) that payments made under a section 9 (e) contract, over and above operation and maintenance costs, will be credited to the construction cost obligation of the contracting organization when it enters a section 9 (d) contract. In addition, the bill would permit existing repayment contracts to be replaced with new contracts which would conform, as nearly as practicable, to the provisions of section 9 (d) and (e), as amended.

The consolidation of the Parker Dam Power project and the Davis Dam project was proposed in House bill 2984. This bill would permit economies and increased efficiency in the construction, operation, maintenance, and administration of these projects.

House bill 1694 would authorize the repayment of rehabilitation and betterment costs to be deferred in those cases where current financing of such work is beyond the repayment ability of the water users.

House bill 4403 would authorize the Secretary of the Interior to develop, administer, and dispose of the recreational facilities within reclamation, flood-control, power, and other Federal reservoir projects under his jurisdiction. Similar legislation applicable only to facilities on the Colorado-Big Thompson project is proposed in House bill 5134.

The development of certain works in the American River Basin, California, as a part of the Central Valley project would be authorized by House bill 165. In addition, this bill would provide that, after construction is completed, Folsom Dam and Reservoir would be transferred by the Corps of Engineers to the Bureau of Reclamation for operation and maintenance.

Also of importance is House bill 940, the Alaska development bill, which, among other things, would authorize the construction of the Eklutna power project near Anchorage.

Several project authorization bills were pending, but had not been acted upon finally at the close of the fiscal year. These include Senate bill 75, to authorize the Central Arizona project, and provide for the construction of the Bridge Canyon Dam and Reservoir as one of its features; Senate bill 276, to authorize the Fort Sumner project, New Mexico; Senate bill 1382, to authorize the Vermejo project, New Mexico; House bill 2733, to authorize the Canadian River project, Texas; Senate bill 167, to authorize the Weber Basin project, Utah;

and House bill 163, to authorize the construction of canals for the irrigation of presently dry areas on the east and west sides of the Sacramento River as part of the Central Valley project.

There would be restored to the Secretary of the Interior, if Senate bill 1606 is enacted, the determination of the validity of titles to lands acquired in the administration of the reclamation laws. In 1946, the Attorney General held that the final determination of title validity under existing law must be made by the Department of Justice.

A favorable report was made by the Interior Department on House bill 2514, which would enable the Secretary of Agriculture, through the Farmers Home Administration, to extend financial assistance to entrymen on Federal reclamation projects.

Among the bills pending in Congress in which the Bureau of Reclamation is interested and on which unfavorable reports have been made are House bill 915, intended to authorize the Department of Agriculture to investigate and report on projects for the reclamation of lands by drainage; that portion of House bill 5472, the Omnibus Flood Control and Rivers and Harbors bill, which relates to the construction of the Grand Prairie reclamation project, Arkansas, by the Corps of Engineers, and Senate bill 33, which would create a National Water Conservation Authority to study the conservation, development, and utilization of the Nation's water resources.

Litigation

The Bureau was concerned with extensive litigation involving important legal principles affecting its operations. Four additional actions were filed against the United States in the Court of Claims during this fiscal year to receive compensation for damages alleged to have been sustained by the plaintiffs as a result of the construction and operation of Friant Dam, Central Valley project, California. This brings the number of such cases to 52, in which over $2,000,000 in damages is sought.

The United States Supreme Court granted certiorari to review the judgments entered by the Court of Claims and heard arguments in the case entitled *Gerlach Live Stock Company* v. *United States*, and five related cases (102 C. Cls. 392; 76 F. Supp. 87, 99). The Supreme Court subsequently decided to have these cases reargued at its next term. In addition, suits are pending in the United States District Courts for the Southern District of California and for the District of Columbia which seek to enjoin the United States from diverting and transporting waters of the San Joaquin River to lands outside the watershed of that river or from entering into contracts for the sale of water of the San Joaquin River.

An action was filed by the United States in the United States District Court for the District of Colorado against the Northern Colorado water conservancy district, the city and county of Denver, and others. The principal purposes of the suit are to quiet the United States title in the waters of the Blue River required to operate Green Mountain Reservoir of the Colorado-Big Thompson project and to obtain a judicial construction of the meaning and effect of certain portions of Senate Document 80, Seventy-fifth Congress. An answer filed by the Public Service Co. of Colorado challenges the statutory authority of the Secretary of the Interior and the constitutional authority of the United States to construct transmission lines.

There are still pending the cases entitled *Fine Sheep Co.* v. *United States*, *Ira R. Ure et al.* v. *United States*, *Ira R. Ure* v. *United States*, and *Scheff White et al.* v. *United States*, and consolidated cases, instituted in the United States District Court for the District of Oregon pursuant to the Federal Tort Claims Act. These cases include 191 actions for alleged damage to crops by reason of a failure to deliver water and two actions for alleged damage caused by flooding resulting from a break which occurred in the North Canal of the Owyhee project. Assistance was given the Department of Justice in the conduct of the trial of these cases and the preparation of legal briefs and arguments.

An action entitled *Washington Water Power Co.* v. *United States* was instituted in the United States Court of Claims to recover for damages allegedly caused to the plaintiff's Little Falls power plant on the Spokane River in the State of Washington by reason of the filling of the Franklin D. Roosevelt Reservoir, Columbia Basin project.

In the case of *United States* v. *Alpine Land and Reservoir Company*, which has been pending for more than 20 years in the United States District Court for the District of Nevada, a preliminary determination and adjudication and a temporary restraining order was entered providing for the distribution of the waters of the Carson River in Nevada.

Assistance was given representatives of the Department of Justice in two cases pending before the United States District Court for the District of Utah. These actions are entitled *Provo Bench Canal and Irrigation Company et al.* v. *United States*, which involves an appeal from a ruling of the State engineer affecting the water rights acquired by the United States for the Provo River project, Utah, and *United States* v. *Lloyd*, which was instituted by the Government to enjoin the operation of a fish-processing plant that was polluting the water stored in the Deer Creek Reservoir of the Provo River project.

The United States Circuit Court of Appeals for the Tenth Circuit affirmed a District Court decision against the United States in the declaratory judgment action entitled *United States* v. *Pruden et al.*

(172 F. 2d 503). This case was instituted to determine the rights of the United States under an Oklahoma statute granting a free right-of-way for canal purposes to the United States across State land in those instances where such lands were conveyed by the State without an express reservation in the deed of the right-of-way.

Possible means of bringing to a conclusion the case of *Pioneer Irrigation District* v. *American Ditch Association et al.*, *United States of America, Intervener*, were explored with representatives of the Department of Justice. This action, which has been pending for many years in the Seventh Judicial District Court of the State of Idaho, was instituted to determine the rights of the several parties to the waters of the Boise River.

A hearing was held before a commissioner appointed by the United States Court of Claims in the action entitled *Columbia Basin Orchard et al.* v. *United States*, which arose by reason of the alleged contamination by the United States of the source of water of the Columbia Basin orchard.

Two suits involving one prime contractor and one subcontractor, entitled *David A. Richardson* v. *United States* and *Ralph G. Barnes* v. *United States*, were filed in the Court of Claims pursuant to the War Hardship Claims Act on account of losses allegedly sustained under six contracts because of war conditions. Legislation is pending which would authorize District Courts to ascertain the amount of losses, if any, sustained by four contractors because of the Government's failure to furnish steel during the steel shortage of 1945 and 1946.

The Court of Claims ruled against the Government in the case *Cotton Land Company et al.* v. *United States* (109 C. Cls. 816). This action was instituted to recover damages for the flooding and isolation of plaintiffs' lands allegedly resulting from the formation of a delta in the Colorado River which was caused by the construction and operation of Parker Dam. The determination of the amount of damages is now pending.

A settlement was made and final judgment entered in the Court of Claims case entitled *California Zinc Company, et al.* v. *United States* (112 C. Cls. 577), involving a claim which resulted from the impounding of water in the Shasta Reservoir, Central Valley project.

Over 100 proceedings to acquire lands and rights-of-way by condemnation were instituted during the fiscal year. Many of these cases involve the acquisition of two or more parcels of land. The acceptability of proposed settlements, awards of commissioners appointed by the courts and of juries in many of these cases, and cases instituted previously were considered.

General.—Legal research, assistance, and draftmanship in connection with all phases of the Reclamation program has been carried on in the Office of the Chief Counsel. Some of these matters include: Consideration of the effect of the 1944 Mexican Water Treaty on certain Bureau project operations; preparation of a draft of consolidated form of all major delegations of authority granted to the Bureau of Reclamation by the Secretary; preparation of general regulations relating to the opening of public lands on Federal reclamation projects; assistance to the Gila Valley power district and Mohawk municipal water conservation district in the liquidation of their indebtedness through composition proceedings which will permit the dissolution of these districts and the formation of a new district authorized to contract with the Government, in accordance with the provisions of the Act of July 30, 1947 (Public Law 272, 80th Cong., 1st sess.); consideration of many questions arising out of limitations which were included in the appropriation act for this fiscal year; and negotiation and drafting of repayment contracts, amendatory repayment contracts, construction contracts, and power contracts, together with a consideration of the legal problems arising out of proposed provisions. Many claims against the United States were considered under a delegation to all Bureau Regional Counsel to administratively determine claims up to $1,000 filed under the Federal Tort Claims Act and the claim items appearing in the annual appropriation acts. The general work range included practically the entire field of Reclamation activity.

MANAGEMENT PLANNING

Organization and Management

No changes were made in the Bureau's basic organization structure during the year. Adjustments were made in the Denver and field design organizations and in the scope of certain district offices. Plans were made toward full participation by the Bureau in the President's management improvement program (officially promulgated on July 29, 1949).

Manual of Instructions

The Reclamation Manual, which will encompass all policy and procedural instructions, methods, and standards for carrying out the Bureau program, was substantially completed in initial form. Substantial progress was also made in a revision of the preliminary material based on its application to operating conditions in the field.

Reports and Forms Review and Coordination

Near the close of the fiscal year, a review of all forms used in the Bureau was initiated. This forms program, together with the analysis and coordination of reports, will provide a system through which the regional personnel and the Commissioner's staff offices may jointly review and improve Bureau reports and forms, and the procedures governing their use.

Administrative Review

The administrative review program was continued on a relatively limited scale, but with good results. Selected functions of the Bureau were reviewed jointly by the branch or office having primary responsibility for the function and by management personnel, and plans and recommendations developed for the improvement of operations and the resolution of organizational problems.

PERSONNEL

Although still restricted by congressional limitations on the number of employees who could be engaged on personnel work, the Bureau personnel staffs have striven to achieve the objectives described in the Annual Report for 1948. The large postwar void between the thin crust of old and able career leaders on the top and the mass of new recruits on the bottom has been progressively narrowed. Development and utilization programs upon which will depend the Bureau's success of 10 or 20 years from now have been initiated. The total objectives of these plans is the development of practical means whereby management can attract and keep positions filled with competent people and have available a reserve of qualified employees selected and trained in advance for promotion or reassignment to new positions in accordance with anticipated scheduled replacements based on forecasts of future staffing needs.

This year brought more and more recognition and reliability to the fact that personnel administration is a direct responsibility of operating management. At every possible level in the program, the available personnel staff devoted itself to assisting management in the establishment, development, and maintenance of a work force which would most effectively meet the Bureau's operational requirements. The second year of Bureau-wide operation of the student engineer program marked its continuance as a well-organized and stable development plan. Pilot programs for junior administrative trainees, apprenticeship training in the six basic crafts, and rotation of engineers in the beginning professional grades have been started. Based upon experience gained with these pilot operations, they will be extended to other regions, districts and projects where needed. Other programs now under way on a pilot basis include the planning and programming of personnel requirements, the use of the construction engineer position as a guide for selecting and developing employees for more responsible assignments, and manpower scheduling for field-design offices.

Position classification to determine appropriate service and grades for positions under the Classification Act was geared to and focused upon creating understanding and effectively utilizing position classification for the benefit of better management. Through inspection surveys and review of decentralized field operations it is planned to evaluate existing allocations and to develop policies and procedures to improve and standardize the conduct of this important responsibility of personnel management.

A collective-bargaining type of labor agreement affecting several hundred wage board employees has been initiated on one major Reclamation project. Equitable hourly rates, based upon the principle of paying employees in accordance with local prevailing rates were kept current by the Bureau's wage boards.

Through its labor relations officers, salary and working conditions for approximately 18,000 contractors' employees were considered. These officers are in close touch with local and national civic organizations, labor unions, contractors, and many others who concern themselves with this working force.

Continued operation of the Bureau's safety program resulted in a 25-percent reduction this year in the lost-time frequency rate under the rate established during 1948. Safety inspections were performed on all Bureau operations and a safety educational program was conducted.

The Bureau continued to enjoy its hard-won prestige as a good place in which to work. More than 12,500 people applied for examinations announced by the Bureau's Central Board of Civil Service Examiners. As a result of these examinations, approximately 1,500 candidates obtained competitive civil service status appointments. On June 30, 1949, the Bureau had on the rolls 15,653 employees; 12,074 of whom were under the Classification Act; 3,505 under the wage boards, and 74 on other types of appointments. Of this number 7,896 were veterans.

Such incentives as rewards for superior accomplishment, and suggestions, paid off to 73 employees in the amount of $8,924, with Earle D. (Dusty) Rhoades, drilling superintendent of the Columbia River district, being awarded $1,000 for his "multiple packer" drilling device, which held promise of saving large sums of money in the construction of dams.

SUPPLY

Airplane Operations

Three Fairchild, single-engine, four-place aircraft were procured from surplus and completely overhauled and modernized for use throughout the Bureau. One of these airplanes was assigned to region VI, one to region VII, and one is awaiting assignment, and temporarily assigned to the Washington Office. The Bureau's Lockheed Lodestar was flown approximately 300 hours during the year, and provided transportation for members of the Secretary's staff, as well as for Bureau officials. This aircraft, as well as the two twin-engine Beechcraft, one of which is assigned to region VI and the other to region III, have been used for inspection work at Bureau projects, which could not have been accomplished except through this means of transportation. In addition to providing a means of visual inspection of dam sites and all projects under construction, the aircraft have been used for making preliminary surveys of transmission lines, the surveillance of flood-water conditions, and for photograph work, including some aerial survey work.

Two of the Bureau's fleet of airplanes were lost in a fire at Amarillo. Provisions have been included in the 1950 Appropriation Act to procure replacements for these aircraft.

Procurement Activities

Work with reference to the decentralization of the Bureau's procurement work has gone steadily forward during the year. Field procurement offices have been delegated authority to consummate contracts where the amounts do not exceed $200,000.

An agreement was consummated through the Secretary of Commerce to have allocated to the Bureau all steel needed to keep our construction program on schedule. This steel allocation program was abandoned during the last quarter when the steel market broke and steel became generally available. Had it not been for our participation in the steel allocation program, a number of our construction projects would have been delayed.

The very tight supply situation, with reference to aluminum conductor cable, large size insulators and certain types of pole line hardware, was overcome due to a tabulation of the entire Bureau needs for these commodities and a presentation of these requirements to the various sources of such materials. As a result of this scheduling of our needs, we are now in a position to procure these items on relatively short delivery schedules.

We have continued our efforts to procure favorable rates for transporting materials being shipped to Bureau projects, and as a result of placing freight rate specialists in the several regional offices we have reduced the cost of transporting materials being purchased by the Bureau for use in projects presently under construction. A plan for controlling Bureau purchases and of coordinating such purchases with the design and construction program has been developed and is presently being placed in operation on a trial basis at one of our large projects.

During the year we have audited and inspected procurement activities at regional and project levels. Such audits have revealed that generally the procurement work of the Bureau is on a sound basis and that personnel assigned to this work are qualified to perform such functions in accordance with the laws, rules and regulations governing this work. These inspections have confirmed the fact that the Bureau's policy to decentralize such activities was sound and that it, generally, has resulted in reducing the time element necessary to procure materials, supplies and equipment, and as well has effected economies and assured such items being delivered when needed.

Studies have been undertaken during the year with a view to reducing the paper work involved in open market buying, and representatives of this office have cooperated closely with the Bureau of Federal Supply and other governmental agencies in the development of a new type of procurement document that will serve as a requisition, purchase order and voucher and which, we are convinced, will result in a savings in the paper work involved in this sort of procurement work.

Property Management Activities

During the year a vigorous campaign has been conducted to assure the handling of Bureau property in accordance with manual instructions.

Inspections have been made at many of our projects and district offices, with the result that property accountability and property utilization throughout the Bureau are generally much improved over what they were a year ago. The need for better utilization of the Bureau's automotive equipment has been stressed and considerable progress has been noted in this field of activity. Methods of checking maintenance practices have been studied and preventive maintenance procedures developed that have reduced materially the cost of operating the Bureau's fleet of automotive equipment. A program for the registration and relicensing of all the Bureau's automotive equipment has been undertaken and has been completed. Various activities in the office of the Commissioner located at Denver have been consolidated, with resulting economies and efficiency.

Office Services Activities

A complete review of the Bureau's file manual was undertaken and is practically completed. The revisions of the Bureau's file classification outline have been such that the new activities that have been undertaken in the Bureau, since the original file outline was developed, have been provided for and more detailed instructions included in the file outline to assure more accurate classification of Bureau correspondence at all levels.

During the year plans were developed to establish in Denver a depository for personnel records of all employees that have been separated from the Bureau and for the handling of records of projects that have been turned over to water users or have been abandoned, or otherwise terminated. Approval for the continued operation of the Bureau's regional duplicating plants, including the Bureau's duplicating plant at Denver, was procured from the Joint Committee on Printing.

An arrangement was worked out whereby a large percentage of the Bureau's teletype business is now being handled through the leased lines of the Public Buildings Administration, with substantial savings to the Bureau and with practically no delay in the transmission of our messages through this means of communication.

REGIONAL REPORTS

Region 1

Project planning.—The principal achievement in project planning for fiscal year 1949 was coordination of the Interior Department's report on the comprehensive development of the Columbia River Basin and the so-called "308" Report of the Department of the Army, under an agreement dated April 11, 1949. The coordination included a joint recommendation for the adoption of the power revenue pooling plan proposed in the Interior report and covered such important matters as the division of jurisdiction for the investigations and development of multiplepurpose projects in the Basin.

Related to the work on the Columbia River Basin report were the completion and submittal of seven supplemental reports on projects originally recommended for authorization in the Basin report. These included: Bitterroot Valley project, Montana; Vale project—Bully Creek extension, and Crooked River project, both in Oregon; Upper Star Valley project, Wyoming; Council project, Mountain Home project—Payette division, and Hornet Creek project, all in Idaho. In addition, a report on the North Side pumping division of the Minidoka project was submitted. Other reports completed during the year included those on the Palisades Dam and Reservoir project, completion of American Falls power plant, and two reports on the rehabilitation of the Ochoco Dam. Three reconaissance reports were completed and work was underway on two others. Continuing study was made of 2 river-basin surveys and 29 project investigations.

Construction.—The Columbia Basin project had $125,360,000 in construction, supply, and equipment contracts in force—a total unequaled in the history of any Reclamation development. At year's end, irrigation works were approximately 13 percent complete and power installations 65 percent finished. All work on irrigation structures continued to be aimed at the Bureau's goal of having water available for approximately 87,000 acres of land in the spring of 1952.

The Bureau marked "completed" the Long Lake Dam, and the pumping plant and distribution system for the 5,400-acre Pasco unit. On other jobs, the following completion percentages were reached: Grand Coulee Dam pumping plant, 31 percent; feeder canal, 28 percent; north dam, 6 percent; south dam, 98 percent; main canal, 68 percent; east low canal (first section) 95 percent; west canal (first section) 96 percent; Soap Lake siphon (west canal) 5 percent; and O'Sullivan Dam, 99 percent; Burbank unit, 56 percent.

At the Grand Coulee Dam, work pushed ahead on many fronts. Emergency riprapping was started along the banks of the Columbia River below the dam to repair damage wrought by the record-breaking floods of 1948 and to curb possible flood damage in future years.

Construction of Hungry Horse Dam was officially begun on July 10, 1948. The south fork of the Flathead River was diverted and cofferdams sufficiently completed to permit unwatering and starting excavation in the river channel. Clearing of the reservoir area under existing contracts proceeded at good pace. Facilities for showing the project to visitors were also completed and lecture service initiated.

On the Boise project, the construction of the remaining laterals to serve the 25,000-acre pumping unit of the Payette division was under contract, with completion scheduled in time for the 1950 irrigation season. At Cascade Dam, source of water supply for this area and for supplemental service for 83,500 acres in the Emmett Valley, work centered around the relocation of existing properties. Work at Anderson Ranch Dam was confined largely to completion of the spillway, outlet works, and powerplant, all of which are scheduled for completion next summer. Relocation of the Forest Service road and reservoir clearing will be completed early in fiscal year 1950.

The remaining laterals of the Deschutes project system to serve 50,000 acres of new land were completed. Work on Wickiup Dam, major project storage reservoir, was practically finished at the end of the year. Work was begun late in the fiscal year on the rehabilitation of the Ochoco Dam in the Crooked River Basin.

Construction of laterals for the 17 pump areas, embracing 27,000 acres of the 72,000-acre Roza division of the Yakima project was virtually completed. Activities under the rehabilitation program included completion of spillway channel improvements and purchase of spillway gates for Keechelus Dam, opening of bids for the rehabilitation of Tieton Dam and spillway, and opening of bids for rehabilitation of pump discharge and siphon lines for the Prosser irrigation district.

On the Lewiston Orchards project, the pipe distribution systems were brought to approximately 50 percent of completion. Work was started on construction of the water treatment plant. Completion of the project works is scheduled for early in fiscal year 1951.

At Palisades Dam, construction was started on the 51-mile long Palisades-Goshen transmission line. The first pumping plant was placed in operation on one of the test wells of the North Side pumping division of the Minidoka project. Operation of this pump will serve as a pilot installation to determine factors bearing on plans for the irrigation of 64,000 acres by pumping from underground water supplies. Construction was completed on the Locket Gulch wasteway of the north canal on the Owyhee project. On the Hayden Lake Unit of the Rathdrum Prairie project, the pumps were repaired, and 8,500 linear feet of the pump discharge line were reconstructed. A contract was awarded for the reconstruction of the Rock Creek Diversion Dam on the Bitterroot project.

Power production.—The output of five Bureau projects in the region rose to a record high of 9.3 billion kilowatt-hours. Gross revenues also reached a new peak, $9,768,852.

Grand Coulee produced 9.1 billion kilowatt-hours during the year. Its gross revenues were $9,175,034. The 13,400-kilowatt Minidoka power plant produced approximately 111 million kilowatt-hours, to earn gross revenues of $437,612. The Boise project, with the 8,000-kilowatt Black Canyon and the 1,500-kilowatt Boise River plants, produced 71.4 million kilowatt-hours and earned $97,617 in gross revenues. The 2,400-kilowatt Prosser power plant on the Yakima project generated nearly 23.5 million kilowatt-hours to earn $58,589 in gross revenues.

Operation and maintenance.—The 16 projects in the region produced $202,639,040 worth of crops in 1948 on a cultivated area of 1,910,502 acres, consisting of lands receiving either a full or supplemental supply of water. The total was third highest on record. The previous peak was $225,235,236, reached in 1947. The 1948 per acre gross return, $106.07, was second highest of record, being exceeded only by the $120 per acre gross of 1947.

A total of 1,112 ex-servicemen qualified for the region's lone homestead drawing of the year, held on the Minidoka project on March 3.

Forty-six public land farm units, embracing 4,465 acres on the Hunt unit, were acquired by veterans.

Ten farm units, comprising 846.5 irrigable acres of public land on the Pasco unit of the Columbia Basin project, were sold to as many World War II veterans, the land sold being that purchased by the Bureau from excess landholders. During the next fiscal year, drawings will be held for 48 farm units, involving approximately 4,377.6 irrigable acres on the Payette division of the Boise project, and 11 farm units, aggregating 723.5 irrigable acres on the Roza division.

The Pasco unit of the Columbia Basin project, where 119 acres were irrigated, received water for the first time. Federal irrigation service was extended to the following additional acreages: Boise project (Black Canyon irrigation district, second unit), 1,861 acres; Deschutes project (north unit), 13,200 acres; Minidoka project (Hunt unit), 2,736 acres; Yakima project (Roza division), 6,408 acres; and Rathdrum Prairie project (Post Falls unit), 1,083 acres.

A third "development" farm was put into service on the Columbia Basin project. Working hand-in-hand with the Bureau on this important research program are the Department of Agriculture's Bureau of Plant Industry and Soil Conservation Service, and the Washington State Experiment Station. The Bureau also began studies of sprinkler irrigation on two other areas of the project. Settler assistance programs were inaugurated on the Pasco unit.

Negotiations for new, amendatory supplemental or interim repayment contracts were underway for 27 irrigation districts; namely, the Frenchtown and Bitterroot in Montana; Okanogan, Kittitas, Roza, Prosser, and Sunnyside in Washington; Vale, Arnold, Jefferson (Deschutes), Westland, Stanfield, Hermiston, West Extension, Ochoco, and all seven districts of the Owyhee project in Oregon; and American Falls, Gem (Owyhee), Black Canyon, Hayden Lake, and Riverside in Idaho.

Full agreement on basic principles and terms to be incorporated into amendatory contracts was reached with district boards of the Ochoco, Prosser, Westland, Stanfield, and Vale districts. Interim contracts were executed with the Jefferson water conservancy district, the American Falls Reservoir district No. 2, the Prosser irrigation district, and the Roza irrigation district. A supplemental contract was executed with the Sunnyside irrigation district, and long-range repayment contracts were executed with the Arnold irrigation district, Bitterroot irrigation district, Hayden Lake irrigation district, Kittitas Reclamation district, and the Okanogan irrigation district. Authorization of the North Side pumping division of the Minidoka project and reauthorization of the Palisades project were effected. Extensive programs in the control of weeds on Bureau rights-of-way were carried out.

Region 2

Project planning.—Major developments in the planning program for the year were the authorization of the Solano County project, California, on January 28, 1949, and the transmittal of the "Comprehensive Plan for Water Resources Development, Central Valley Basin, California" to the President through the Bureau of the Budget on July 29, 1948.

Other significant developments included preparation of a preliminary draft of the report on the "North Fork Kings River Development, Central Valley Basin Plan, California," and the preparation of a supplement to the legislative report on American River development for use in congressional hearings.

Despite limitations upon personnel, the planning program moved steadily forward. Substantial progress was achieved upon the San Luis Obispo, Sacramento River Canals, Trinity River diversion, Feather River, Klamath Basin and Pajaro River investigations.

Construction.—Shasta Dam is essentially complete except for miscellaneous minor finish work. Three 110 x 28-foot drum gates were installed during the year, which will provide additional storage of 800,000 acre-feet, bringing total reservoir capacity to 4,500,000 acre-feet.

Three major construction contracts are under way for completion of Keswick Dam and power plant. Construction under these contracts will complete the work delayed during the war. The three 25,000-kilowatt generating units in Keswick power plant will be completed and ready for operation by the end of calendar year 1949.

Two 230-kilovolt west side steel tower transmission lines were completed for a distance of 22 miles from Shasta power plant to a point opposite the PG&E Shasta substation near Cottonwood.

The two principal contracts for construction of the Tracy pumping plant, including the intake canal, and the three 15-foot diameter steel and concrete discharge pipes are approximately 78 percent complete. A contract was awarded in June 1949 for installation of the pumping equipment being manufactured in the east, with completion scheduled for June 1951.

The 120 mile long, 4,600 cubic feet per second Delta-Mendota Canal is approximately 27 percent complete. Work on 43.5 miles of the canal is under way under three major construction contracts. Construction for a distance of 23.2 miles has been completed.

Friant Dam and Reservoir are essentially complete except for minor finish work. Removal of the two temporary needle valves borrowed from Hoover Dam during the war and the installation of four permanent 96-inch hollow jet valves in the river outlet section and also four 96-inch hollow jet valves in the Friant-Kern Canal outlet sectio is nearing completion.

The 153 mile long, 4,500 cubic feet per second Friant-Kern Canal is approximately 62 percent complete. The first 75-mile section to Kaweah River is complete and was put into interim operation on July 9, 1949.

Start of construction work on the Santa Barbara project has been temporarily deferred pending execution of a water-service contract and completion of other preliminary work.

Power production.—Shasta power plant was essentially completed with the fourth unit going in service in July 1948 and the fifth and final in April 1949. The first segment of west side line No. 2 from the Shasta power plant to the vicinity of the Pacific Gas & Electric Co. substation, with an emergency tap to the substation was energized.

Fiscal year 1949 showed the greatest generation and greatest revenue thus far from Shasta power plant. Energy sales were 1,681,760,468 kilowatt-hours and annual revenue was $6,523,225.22; this figure being almost double that for fiscal year 1948. On December 31, the contract with the Pacific Gas & Electric Co., which had been in existence since 1944, expired. The company continued its policy of refusing to furnish electricity on a conveyance or exchange basis other than for Central Valley project pumping use. Because Shasta power was vitally necessary to the economy of the State, on January 1, 1949, the Bureau entered into a written agreement with the Company which provides that the capacity and energy which the Bureau may declare available for disposition to the company on any day shall be announced to the company on or before the day previous, and the company shall be obliged to take and pay, or pay, for all capacity and energy so declared available.

Hearings on the formal complaint by the United States against the Pacific Gas & Electric Co. before the California Public Utility Commission, seeking to establish a class of service and a rate for the exchange or conveyance of public power over intervening private utility transmission systems were concluded in December 1948. The Commission had not rendered its decision at the close of the fiscal year.

A number of conferences were held with representatives of industrial concerns regarding the availability of power capacity from Shasta power plant.

Operation and maintenance.—Operating the Central Valley project during the fiscal year 1949 involved the handling of 4,425,980 acre-feet of inflow to Shasta Lake and 1,236,710 acre-feet of inflow to Millerton Lake. The multiple purposes of Shasta Lake were served by releasing 4,368,250 acre-feet of water, all of which passed through the Shasta power plant. Of the water handled in Millerton Lake, 100,560 acre-feet were diverted to the Madera Canal, 3,000 to the Friant-Kern Canal, and 1,178,670 were released through the river outlet valves for the downstream users. Diversions by the Contra Costa Canal system to supply industrial, municipal, and irrigation requirements totaled 18,640 acre-feet. Total revenues from sale of agricultural water for irrigation of 250,000 acres and from municipal and industrial water sales are estimated at $700,000.

Land classification activities during fiscal year 1949 included completion of mapping on approximately 204,000 acres of land, 36,000 acres of land were mapped in detail and semidetail surveys were made on 168,000 acres.

The Annual Crop and Livestock Census for Klamath, Orland, and the Central Valley projects was completed. Crop returns from the total irrigated area of 390,000 acres were: Klamath, $17,540,000; Orland, $1,410,000; and Central Valley project, $31,200,000. The regional total of $50,150,000 was $6,600,000 less than the figure for the preceding year. Average crop value declined from $149 to $129 per acre.

Public Notice No. 47, dated August 27, 1948, opening 8,283 acres in 86 units, located in parts 1 and 2 of Tule Lake division, Klamath project, was prepared and issued. The drawing for the 86 units was held on February 23, 1949. A total of 258 candidates and alternates were selected.

On the Central Valley project, contract negotiations were carried to completion and contracts executed with the Lindsay-Strathmore, Lindmore, and Orange Cove irrigation districts, and the Shasta Dam area and Summit City public utility districts.

Region 3

Project planning.—Congressional committees considered bills to authorize the Central Arizona project. Project planning investigations of several years culminated in the near-completion of reports on the Dixie and Santa Margarita projects. The Moapa Valley investigation is advanced so that conclusions can soon be drawn. Region 3 field forces, cooperating with region 4, completed a major part of the investigations of the preferred dam site in Glen Canyon on the Colorado River just above Lee's Ferry.

Approval of legislation authorizing delivery of water to the Yuma Auxiliary project through the Gila project works was obtained. Negotiations with the North Gila Valley irrigation district for delivery of water to district lands in the North Gila Valley were continued. Intensive investigations of sprinkler irrigation possibilities on the Yuma Mesa division of the Gila project were undertaken. A rehabilitation survey on the Valley division of the Yuma project was completed and work initiated under the water users' annual budget. Rock was placed in Palo Verde Temporary weir intermittently as required. Field work on the Lake Mead sedimentation survey was completed and a preliminary survey of necessary levee improvements in the Yuma area made.

Construction.—The construction and planning programs throughout the region moved forward with these high lights: (1) completion of the Davis Dam embankment; (2) completion of portions of the major Davis transmission system features; (3) turning over of Coachella Canal to water users; (4) construction progress on Coachella distribution system; (5) opening of bids for initial construction on the Wellton-Mohawk Canal; (6) beginning of dredging on the Colorado River; (7) settlement of homesteaders on Gila project; (8) consideration by the Congress of the Central Arizona project; (9) ordering of two main generating units for the Hoover power plant.

Late in June 1949 bids were opened for the construction of the first 8½ miles of the Wellton-Mohawk Canal on the Gila project. The contract was awarded the Fisher Contracting Co. of Phoenix, Ariz., at a price of $1,335,463.70. Contracts were awarded earlier in the year for pumps and motors for each of the three pumping plants to be built on the canal.

Contracts were awarded for generating units A–3 and A–4, each of 82,500-kilovolt-amperes rating. The units will be installed in the Hoover power plant to supply Arizona's allotment of Hoover energy. The site for the new 230-kilovolt States' switchyard at Hoover Dam was selected and design work started.

The State of Nevada requested the installation of a 62,500-kilovolt-ampere unit in the Hoover power plant to make available to Nevada a portion of its allocation of Hoover energy. Specifications for this unit were issued.

Some 4 million cubic yards of earth and rock had been placed in the Davis Dam embankment up to the close of the year to bring that feature of the project to completion. Powerhouse foundation concrete was placed and the five turbines and generators were delivered and are awaiting installation. The second Phoenix-Tucson 115-kilovolt transmission line, the third synchronous condenser at Phoenix, and the second Gila-Yuma 34.5 kilovolt transmission line were completed and placed in operation.

Power production.—Hoover, Parker, and Siphon Drop power plants generated over 6½ billion kilowatt-hours, exceeding the previous year's output by about 5.7 percent and coming within 8 percent of the 1944 record. These plants accounted for more than a third of the power produced at all Reclamation projects and furnished nearly 42 percent of the total power consumed in the region. All water released from

Hoover and Parker Dam, except 240,000 acre-feet bypassed at Parker Dam for flood control purposes, was utilized for power production.

Operation and maintenance.—Farmers grossed $153,110,228 on 787,565 acres irrigated by Reclamation facilities for a per acre value of over $194. This was a 13 percent increase over the 1947 crop income. Operation and maintenance of the Coachella Main Canal, below Station 2604, was assumed by the Coachella Valley County water district on March 25, 1949. With construction pushed on the first six of the ultimate nine units of the 76,000-acre concrete-pipe water distribution system for the Coachella Valley, irrigation deliveries were begun through the laterals as they were completed.

Approximately 1¼ miles of main channel were dredged between Needles and Topock by the Bureau's new Colorado River 20-inch hydraulic suction dredge, placed in operation on January 31. More than a million cubic yards of river-bottom material were removed.

Fifty-four farms on the Yuma Mesa division of the Gila project, ranging in size from 40 to 160 acres and comprising 4,940 acres, were settled by war veterans. Plans were initiated for the opening of additional public land in the Gila and Coachella Valleys. The Secretary advised the Imperial irrigation district that the public lands on Imperial East Mesa under the All-American Canal system were not practicable of irrigation and would not be opened for homestead entry under Reclamation law.

Region 4

Project planning.—Eight project planning reports, including emergency production of a report enabling authorization by the Eighty-first Congress of the $69,500,000 Weber Basin project, were issued.

Ratification by the Congress of the Upper Colorado River Compact early in 1949 eliminated uncertainty concerning water rights and cleared the way for an extensive program of water-resources development in the Upper Colorado River Basin. Since the compact terms became known the general plan of development as outlined in "The Colorado River," prepared in 1946 and printed as House Document No. 419, has been refined and amplified under the Colorado River storage project investigation. A preliminary report was prepared, tentatively outlining a desirable combination of reservoirs and an operation schedule to provide the greatest over-all benefits in river regulation, irrigation, power production, flood and silt control, and recreation. Detailed investigations were completed at the Glen Canyon storage site on the Colorado River and at the Echo Park site on the Green River, with investigations under way on other sites for the nine principal multiple-purpose reservoirs described in the report. The project plan provides for financial assistance to other irrigation projects that meet certain criteria. Power revenues not required to pay the cost of power-plant construction would aid the participating projects. It is essential that the incidental hydroelectric power production from all potential main-stem plants would total more than 9 billion kilowatt-hours annually. Potential participating projects for which preliminary reports were prepared during the fiscal year include the Collbran and Florida in Colorado, the Pine River extension in New Mexico and Colorado, and the Seedskadee, Eden, and Lyman in Wyoming. Other potential participating projects on which reports were nearly completed include the LaPlata, Smith Fork, and Silt in Colorado; the Central Utah in Utah; the LaBarge in Wyoming.

The Weber Basin project report, on which congressional authorization in August 1949 was based, outlined a plan for the full use of remaining undeveloped water in the river system. It, together with the Bear River project and the Central Utah project, comprises the principal plans for basin-wide development described in the Bonneville Basin report, completely revised and rewritten during the year. Formulation of a definite plan of development on the Bear River was retarded by disagreement among the States of Utah, Wyoming, and Idaho concerning division of water.

Investigation work in the Lahontan Basin was confined largely to a study of the existing Newlands and Humboldt projects. Further planning work on the Truckee and Carson Rivers awaits completion of the Newlands project studies.

Construction.—Approximately $6,000,000 of a $7,500,000 scheduled program was accomplished; rejection of bids received early in August for the construction of Duchesne Tunnel, Provo River project, Utah, and the Spring Creek Dam, Paonia project, Colorado, accounting for the carry-over. Despite unusually severe winter weather other construction was carried out as programed. The region's seventeenth dam, on the Mancos project, Colorado, was completed.

Seven sets of specifications were issued for canals and structures, small reservoirs, pipe lines, and a tunnel as result of delegations from the Chief Engineer to expedite preparation of designs.

A major contract awarded in August provided for completion of the 41.7-mile Salt Lake aqueduct, Provo River project, Utah. Completion of the Jordan Narrows siphon and pumping plant in May 1949 enabled delivery of water to west Salt Lake Valley lands heretofore dry farmed. Jackson Gulch Dam and inlet and outlet canals, Mancos project, Colorado, were completed by contract in December 1948, more than 18 months ahead of schedule. The Preston Bench project, Idaho, was started from preconstruction and pushed practically to completion within the year through cooperation of the water users, project personnel, and the contractors. The Congress, on June 28, 1949, reauthorized construction of the Eden project in southwestern Wyoming.

Operation and maintenance.—Completion of Jackson Gulch Dam increased the number of reservoirs in the region to 17. Operation and maintenance of the Gravity division of the Grand Valley project, Colorado, and of the Scofield project, Utah, was transferred to the water users organization on January 1 and April 1, 1949, respectively. Reduced yields and lower prices decreased gross crop values to $37,056,326 from 536,325 acres, off $7,697,000 from the record high 1947 crop returns. Water supplies varied from fair to excellent, Nevada's being the most unfavorable.

Pursuant to Public Law 462, amendatory contracts were completed with the water users of the Provo River project, Utah, permitting the rental of project water and works on a year-to-year basis until costs in excess of existing contract obligations have been paid to the Government, rates to be fixed by the Secretary. An amendatory repayment contract with the Uncompahgre Water Users Association was completed in accordance with Public Law 56 authorized by the Eighty-first Congress. A supplemental contract with the South Ogden conservation district, Ogden River project, Utah, was also completed, as was a report on the Humboldt project outlining a plan for alleviating drainage and flood control problems on the project.

Region 5

Project planning.—Investigations were completed and final drafts of feasibility reports on the Vermejo, New Mexico, and Big Creek, Texas, projects were transmitted to the Commissioner's office. The preliminary draft of a report on the Canadian River project, Texas, was also forwarded to the Commissioner. Investigations of the authorized Valley Gravity project, Texas, and a report thereon seeking amended authorization of the project were completed. Program reports on the Robert Lee, Texas, and the Balmorhea, Texas, projects were completed. A feasibility report on the Canton project, Oklahoma, for irrigation development was completed and transmitted to the Commissioner, but the report was returned for consideration of facilities to provide a municipal water supply for the city of Enid, Okla. Studies of the San Juan-Chama project, Colorado and New Mexico, and field work on comprehensive inventories of land and water resources in the Red and Arkansas River Basins and Gulf Basin were continued during the year.

Construction.—Construction work was in progress on four projects. On the W. C. Austin project, the radial gates on the controlled spillway and operating bridge across the dam were installed, thus completing the dam. Construction was completed on the last portion of the lateral system in October 1948. Work was performed in connection with a contract awarded in February 1949 for the construction of a portion of the drainage system. On the Rio Grande project, construction work was completed or well advanced on the following items: paving camp roads at Elephant Butte; Socorro and Alamogordo substation structures; residence at Alamogordo substation, and fencing of Caballo Dam outlet works. On the San Luis Valley project, notice to proceed with work was issued in June 1949 for the construction of Platoro Dam, and actual construction was initiated. On the Tucumcari project, the construction of canals and laterals was continued so that facilities serving unit No. 6 were almost complete and facilities serving unit No. 7, the last unit, were well on the way toward completion. Construction work was completed on the riprap for laterals and five ditch-rider residences with facilities. On the Carlsbad project, work was completed in connection with the drilling of blasting holes in the compacted earth filled embankment of Alamogordo Dam for the emergency flood plan.

Power production.—A part of the Rio Grande project, the hydrogenerating plant at the top of Elephant Butte Dam, consisting of three 8,100-kilowatt generating units, and a transmission system from this plant, constitutes the existing power facilities in region 5. Total energy sold in fiscal year 1949 was 74,891,173 kilowatt-hours, which produced a revenue of $388,524.02. Generation was below normal due to the low water conditions in Elephant Butte Reservoir. Proposed additions to the Rio Grande transmission system in the near future are a 72-mile, 115 kilovolt transmission line from Socorro to Albuquerque with a substation at Albuquerque, and a 50-mile, 115 kilovolt tap transmission line from Bernardo to Willard with a substation at Willard.

Operation and maintenance.—The operation and maintenance activities involved two projects in full operation, two in partial operation, and one water conservation and utilization project in full operation, and one Warren Act contractor. On these projects about 233,681 acres in 8,704 farms supporting a population of 49,892 were irrigated in 1948. Total gross crop income was $52,563,573.

On the Rio Grande project, the 155,715 acres irrigated in 1948 produced a total crop value of $42,820,056 or $273.70 per cropped acre. On the Hudspeth project, water being delivered under a Warren Act contract, 17,153 acres produced a total crop value of $3,997,381 or $233.04 per cropped acre. On the Carlsbad project, the 20,167 acres irrigated in 1948 produced a total crop value of $2,727,119 or $135.23 per cropped acre. On the W. C. Austin project, the 17,433 acres irrigated in 1948 produced a total crop value of $1,558,691 or $89.41 per cropped acre. Irrigation facilities are now complete to serve all of the project's 49,972 irrigable acres. On the Tucumcari project, the 16,069 acres irrigated in 1948 produced a total crop value of $777,572 or $48.39 per cropped acre. As of June 30, 1949, facilities were complete to serve about 29,000 acres of the project. On the Balmorhea project, about 7,570 acre-feet of water was delivered from the Bureau-owned Phanton Lake Spring. The 7,144 acres irrigated in 1948 produced a total crop value of $682,704 or $95.56 per cropped acre. The soil and moisture conservation program for fiscal year 1949 included: the construction of five detention dams and 5,600 lineal feet of diversion terraces on the Lake Altus Reservation, W. C. Austin project; and salt cedar spraying and mechanical clearing and a channelization work for water conservation in McMillan Reservoir delta and inflow area, Carlsbad project.

Repayment contracts on the Fort Sumner project and Platoro unit of the San Luis Valley project were negotiated; negotiations were continued with the cities of El Paso and Tucumcari for water supplies from project sources; and contracts on the Tucumcari project for the sale of water under the Warren Act were negotiated.

Region 6

Project planning.—Investigations to obtain material for basin reports were carried forward on 20 basins and divisions. Preconstruction work necessary to ready units for construction progressed on 31 units. At the close of the year, detailed unit reports were complete on the Cartwright, Lower Marias, Owl Creek, N-Bar-N, and Fort Clark units.

Construction.—Despite some continued shortage of materials and, in some cases, a shortage of labor, the construction program in the region made excellent progress. The following construction contracts were completed: Clearing of reservoir area for Angostura unit; camp buildings and access road for Bixby unit; camp buildings for Boysen unit; road relocation and camp facilities for Canyon Ferry unit; camp facilities and transmission line relocation for Heart Butte unit; prefabricated buildings for Keyhole unit; camp buildings for Moorhead unit; camp facilities for Shadehill unit; Lost Wells lateral system, portion of Wyoming Canal, most of the North Pavillion lateral system, and Pilot Canal laterals for Riverton project; Heart Mountain Canal and laterals, Ralston laterals, concrete chute on Willwood Canal, Heart Mountain power plant and Heart Mountain-Garland transmission lines for Shoshone project.

Satisfactory progress was maintained on those contracts continued from fiscal year 1948 which will not be completed until after fiscal year 1949. Among these construction jobs are Angostura Dam where the contract is 86.2 percent complete despite delays caused by flash floods on the Cheyenne River; the Boysen Dam, power plant and railroad relocation where operations were handicapped by uncertainties as to appropriations, by unusually difficult geological conditions in the railroad tunnel, and by the destruction of the contractor's concrete batching plant by fire; the Heart Butte Dam; canal and lateral work at Riverton; and the Glendive-Miles City and Fort Peck-Garrison transmission lines.

New construction contracts totaling $20,722,159 were awarded on Dickinson, Shadehill, and Canyon Ferry Dams; the Savage pumping plant, canals and laterals; the Watford City, Wolf Point, and Savage substations; groundwires for the Glendive-Miles City transmission line; Heart Butte reservoir clearing; access road for Bixby Dam; relocation of county road approaches to Canyon Ferry Dam; relocation of Fort Peck-Rainbow transmission line; canals and laterals at Riverton; camp facilities for Keyhole, Shadehill, and Moorhead Dams; and housing facilities at Fort Peck. Additional contracts for major equipment totaling $1,184,430 were also awarded as follows: Powerplant transformers, tunnel ventilating equipment, radial gates, circuit breakers and switches for switchyard, penstocks and outlet pipe for the Boysen Dam and power plant; penstocks for Canyon Ferry Dam and power plant; equipment for the Thermopolis, Miles City, Forsyth, and Sidney substations; carrier current telephone apparatus; steel structures for the Williston-Garrison transmission line; and new gates and hoists for the Belle Fourche Dam.

Most contractors have made satisfactory starts on those major contracts let in fiscal year 1949. Labor and materials are becoming more readily available and the period of rising construction costs seems to have ended.

Planned construction on several major jobs did not get under way. The issuance of specifications on Anchor Dam was held up pending clearance of water-right questions on the unit. Issuance of construction specifications for Tiber Dam was delayed pending determination of the attitude of the landowners relative to repayment of irrigation costs. Designs for Cannonball Dam were delayed pending further study of the land available for irrigation so that designs can be drawn for the correct storage capacity. Design work for Bixby Dam was stopped to permit a more thorough analysis of the quality of the water to be impounded for irrigation. Additional design data required for Keyhole Dam and studies of alternate plans delayed the issuance of construction specifications.

Power production.—The addition of a second generating unit of 15,000-kilowatt rated capacity at Fort Peck late in fiscal year 1948 and the completion of the 5,000-kilowatt Heart Mountain power plant early in December increased the generation of Federal hydroelectric power plants in the region, for which the Bureau markets the power, from 294 million in fiscal year 1948 to 446.7 million kilowatt-hours in fiscal year 1949. Over 220 million kilowatt-hours of this energy was delivered to the Montana Power Co. for ultimate use in meeting the critical power shortage in the Pacific Northwest. Five new REA cooperatives were given service, bringing the total served by the Bureau in this region to 22.

Operation and maintenance.—The 11 operating irrigation projects in the region produced a gross crop value of $18,161,000 during calendar year 1948. One hundred and four units, comprising 12,073 acres of irrigable public land, were opened to settlement on April 13 under Public Notice No. 58 on the Heart Mountain division of the Shoshone project. Public Notice No. 28, Riverton project, was issued May 4 and opened to settlement 50 units, comprising 5,912 acres.

Drafts of amendatory repayment contracts were prepared for the Deaver irrigation district (Departmental approval received February 28 and water users' approval April 9); the Belle Fourche irrigation district (Departmental approval received April 4 and water users' approval May 3); the Midvale irrigation district; the Lower Yellowstone irrigation district No. 1; the Lower Yellowstone irrigation district No. 2; and the Huntley irrigation district. Drafts of repayment contracts were prepared for the Heart River irrigation district (Departmental approval received May 3); the Willwood irrigation district (Departmental approval received October 22, water users' approval December 18, and authorization for execution by the United States by act of Congress of May 6); the Buffalo Rapids irrigation district No. 1 and Buffalo Rapids irrigation No. 2; the Malta irrigation district and the Glasgow irrigation district; and the Buford-Trenton irrigation district. The repayment contract with the Savage irrigation district was executed in behalf of the United States on December 10.

Contracts for the repayment of rehabilitation and betterment work were prepared for, and execution secured by, the Malta, Harlem, Paradise Valley, Alfalfa Valley, Zurich, and Fort Belknap irrigation districts of the Milk River project; the Willwood irrigation district of the Shoshone project; and the Fort Shaw irrigation district of the Sun River project. Resolutions were secured from the Belle Fourche irrigation district of the Belle Fourche project and from the Midvale irrigation district of the Riverton project. By the spring of 1949, a total of five development farms were in operation in Montana, North Dakota, and South Dakota.

Region 7

Project planning.—Investigation reports have been coordinated by the region to allow the maximum efficiency in the preparation of the various basin reports. During the year the Lower Platte River Basin report and interim reports for the Blue-South Platte and Gunnison-Arkansas project were completed, reproduced and submitted to all interested State and Federal Government agencies for their review and comments. The two projects, dependent upon transmountain diversion of Colorado River water, will depend for completion of the reports and subsequent construction on the division of water made available under the Colorado River Basin Compact between the eastern and western slopes. Construction of the project facilities will tend to solve the problem posed by irrigation and municipal water deficiencies in Colorado east of the Rockies, provide generation of a large block of sorely needed hydroelectric power as well as flood control and sedimentation benefits.

Work was initiated on the Kansas River Basin report which consists of combining reports already under way on the Republican River and Smoky Hill River Basins together with additional studies on the Blue River and the lower Kansas River area. Water supply studies were revised in compliance with restrictions of the Republican River compact.

Land classification of project lands was continued to bring data up-to-date and to provide a more detailed basis for specific units. In this connection, contracts have been made with various State educational institutions to provide much of the technical personnel in making the various classifications desired. Additional topographic surveys and drilling to determine character of subsurface formation have been made at various dam sites, reservoir areas and along the expected reaches of canal lines.

Assistance was given to local interests in the promotion and formation of irrigation districts in all parts of the region, that in the end, repayment contracts might be more easily executed.

Work continues on the Niobrara, North Platte and South Platte comprehensive plan investigations with the objective of completing basin inventory reports.

Construction.—Construction activities were carried forward in all parts of the region. On the Mirage Flats project only a small amount of force account work remained which will be completed prior to transfer of the project to an operation and maintenance status. On the Colorado-Big Thompson project, 21 construction contracts were in force totaling $35,000,000. Work was completed on the Aspen Creek siphon and Prospect Mountain conduit, four tunnels of the Horsetooth feeder canal, and two of the four dams of the Horsetooth

Reservoir; construction was virtually complete on Olympus Dam and the other two dams of the Horsetooth Reservoir, and was well advanced on Granby Dam, pump plant and canal, and Marys Lake and Estes power plants. During the year new contracts were awarded on the canal portion of the Horsetooth feeder canal, on four transmission lines and two substations. The project is approximately 50 percent complete.

Construction of the vast Missouri River Basin project has progressed rapidly since May 1946 when the first blast was set off to start clearing of the Kortes Dam site. At the beginning of the year contractors were busy on the Kortes Dam in Wyoming; on Enders and Medicine Creek Dams, the Cambridge Diversion Dam, and Cambridge Canal of the Frenchman-Cambridge division in Nebraska; on four transmission lines in Nebraska and Wyoming and on housing units for the Narrows, Cedar Bluff, and St. Francis units. During the year the housing units, three of the transmission lines and the diversion dam were completed, concrete placement was well under way at Kortes, the earth fill for Enders and Medicine Creek Dams was fast taking shape, and the first section of the Cambridge Canal was 67 percent complete. New work started on the project included Bonny and Cedar Bluff Dams, Superior Courtland Diversion Dam, the Superior Canal, two large transmission lines, and two substations.

In addition to the construction activities which were under actual construction, several features were under invitation to bids, for which awards would be made immediately after the end of the year. These include the Pole Hill and Olympus Tunnels on the Colorado-Big Thompson project, Trenton Dam of the Frenchman-Cambridge division, and the Courtland Canal of the Bostwick division.

While most construction projects showed reasonably good progress, others were unable to proceed with scheduled operations because of difficulties beyond their control. The Glendo and Narrows units, scheduled for a start of construction in the spring of 1949 are further delayed until the spring of 1950 and 1951, respectively, because of the uncertain support of State groups over the amount of water available for the reservoirs. The Courtland Canal, Republic Diversion Dam, and other features on the Bostwick division did not reach the design stage because of questions raised on the legality of the present Kansas irrigation laws.

Power production.—The power activities of the region have consisted of the operation and maintenance of the Seminoe, Guernsey, and Lingle power plants in the North Platte River district, and the Green Mountain Dam in the South Platte River district.

The four hydroelectric plants in the region generated 261 million kilowatt-hours of electrical energy, 259 million kilowatt-hours of which were sold to municipalities, REA cooperatives, industrial plants, and public utilities for a gross revenue of $1,713,436.

The outstanding problem the region is confronted with at this time is the rapid rate of load growth to be cared for by the existing power plants. Little relief can be expected until May 1950 when two units of the Kortes power plant with 24,000 kilowatts installed capacity will be put into operation. The Estes power plant with its 45,000 kilowatts installed capacity and the Marys Lake with 8,000 kilowatts are scheduled for completion about August 1950, and the third unit at Kortes in October 1950.

Operation and maintenance.—No group of new facilities were completed on the various projects within the region that would allow irrigation of additional acreages. However, preparation of farm units in the Mirage Flats project allowed the distribution of water to the full 12,000 acres of the project and on the Kendrick project, 2,000 additional acres were placed under irrigation, making a total of 6,000 acres.

At the close of the fiscal year, irrigation in region 7 reached a total of 220,000 acres. Approximately 200,000 acres were irrigated on the Bureau's North Platte project in Wyoming and Nebraska, 6,000 on the Kendrick in Wyoming, 12,000 on the Mirage Flats project and 2,000 on the Frenchman-Cambridge division of the Missouri River Basin project in Nebraska. In addition, supplemental water was delivered to 30,000 acres of the Northern Colorado conservancy district lands and to 110,000 acres of Warren Act lands in the North Platte project.

Division of Power

Walton Seymour, *Director*

* * *

THE Division of Power, a staff agency, assists the Secretary in the supervision of all the electric power activities of the Department of the Interior.

The principal power marketing agencies in the Department are the Bureau of Reclamation, which also produces electrical energy at its own projects; the Bonneville Power Administration, which markets power in the Pacific Northwest; and the Southwestern Power Administration, which markets power in Arkansas and Louisiana, and parts of some of the adjoining States. These agencies market power produced at projects of the Bureau of Reclamation and the Corps of Engineers of the Department of the Army in the Western States. In the Southeast, the Division of Power has had similar power marketing responsibilities for projects of the Corps of Engineers.

In addition to these power marketing activities, other agencies of the Department have power problems which the Division has helped to solve. These include the Bureau of Indian Affairs, the Division of Territories and Island Possessions, the Bureau of Mines, the Bureau of Land Management, and the National Park Service.

The electric power business of the Department of the Interior has grown substantially during the past few years. In the fiscal year 1949, the Department's power agencies marketed over 22.6 billion kilowatt-hours, with revenues from these activities of over $53,700,000, an increase over fiscal year 1948 of 15.5 percent in generation and 20.3 percent in revenue, with corresponding increases of 38.7 percent and 29.8 percent over fiscal year 1947. With the completion of projects now under construction, this power business will continue its rapid rate of growth.

In the Southeast, the Division of Power has been responsible for the preliminary marketing arrangements for the power output of the Allatoona, Dale Hollow, Center Hill, Wolf Creek, Buggs Island, Philpott, Clark Hill, and Jim Woodruff multiple-purpose water-control projects being constructed in the Southeast by the Corps of Engineers of the Department of the Army. These eight projects, which are now under construction, will have an initial capacity of 945,000 kilowatts.

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During the year, negotiations were completed and a contract signed with the Georgia Power Co. for the sale of the power to be generated at the Allatoona project on the Etowah River in Georgia. Allatoona will be completed early in 1950. This contract will bring in about a million dollars a year in revenues. The contract provides that the Government may withdraw energy for sale on a firm basis to preference customers in excess of the firm energy capability of the project.

A contract was completed with the Tennessee Valley Authority for the sale to TVA of the output of the Dale Hollow, Center Hill, and Wolf Creek projects of the Corps of Engineers. These projects are located in the watershed of the Cumberland River, which lies adjacent to the northern edge of the Tennessee Valley. The Dale Hollow project began producing power in December 1948 and produced 92,000,000 kilowatt-hours up to June 30, 1948. Revenues accruing from TVA from this operation during the fiscal year were about $300,000.

Bonneville Power Administration

Paul J. Raver, *Administrator*

MANAGEMENT OF THE ENTERPRISE

POWER sales of the Bonneville Power Administration and net revenues continued a steady growth during the fiscal year and power generation on the Federal system reached new highs. Extension of transmission facilities to carry new generation to power deficit load centers progressed at an accelerated pace but remained inadequate in terms of reserve capacity. Deferred maintenance remained a serious problem on the system.

Energy Production

Electric energy produced at Bonneville and Grand Coulee power plants during fiscal year 1949 totaled nearly 13 billion kilowatt-hours. At present, the Federal Columbia River power system is the second largest producer of power in the nation, exceeded only by the Tennessee Valley Authority.[1]

The total generation of 12,925,788,000 kilowatt-hours exceeded the peak war year of 1944 by 40 percent and represented nearly two-thirds of total energy produced in the States of Oregon and Washington, and over 50 percent of the total produced in the Pacific Northwest region during the 12-month period.

Table 1 and chart 1, Generation at Bonneville and Grand Coulee Plants, show energy production from the beginning of operations to the end of fiscal year 1949, and table 2, Electric Energy Account, presents a summary of total energy receipts, sales, deliveries, and losses.

TABLE 1.—*Generation at Bonneville and Grand Coulee plants for Bonneville Power Administration, fiscal years 1939–49*

Fiscal years ending June 30	Bonneville generation	Grand Coulee generation	Total generation for BPA
	Megawatt-hours	*Megawatt-hours*	*Megawatt-hours*
1939	34, 874		34, 874
1940	208, 426		208, 426
1941	894, 177	7, 455	901, 632
1942	1, 807, 309	741, 844	2, 549, 153
1943	2, 801, 480	2, 816, 956	5, 618, 436
1944	3, 488, 874	5, 750, 950	9, 239, 824
1945	3, 391, 128	5, 660, 446	9, 051, 574
1946	2, 674, 834	3, 561, 329	6, 236, 163
1947	3, 695, 255	5, 058, 482	8, 753, 737
1948	3, 991, 860	6, 894, 047	10, 885, 907
1949	3, 868, 558	9, 057, 230	12, 925, 788
Total	26, 856, 775	39, 548, 739	66, 405, 514

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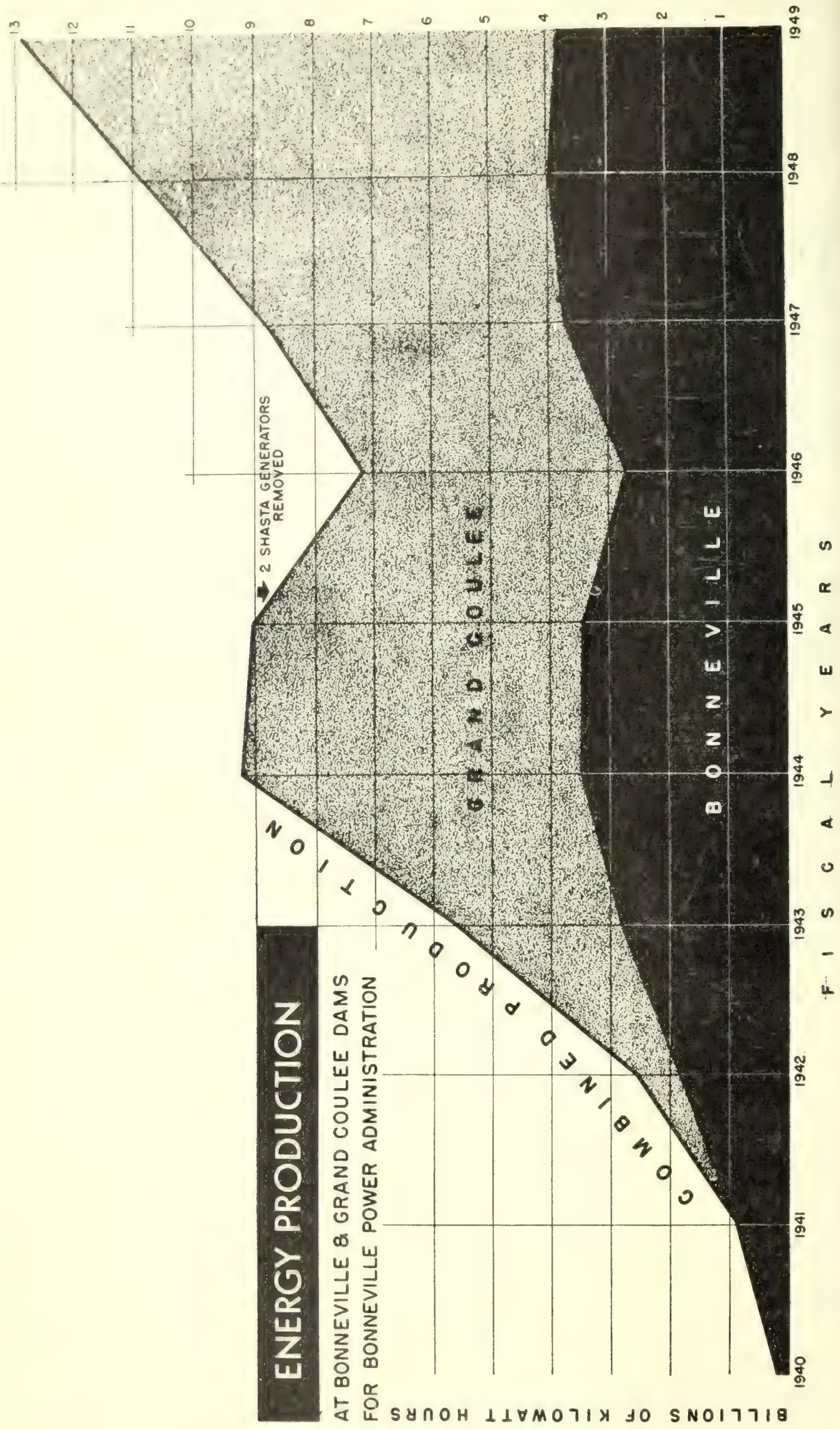
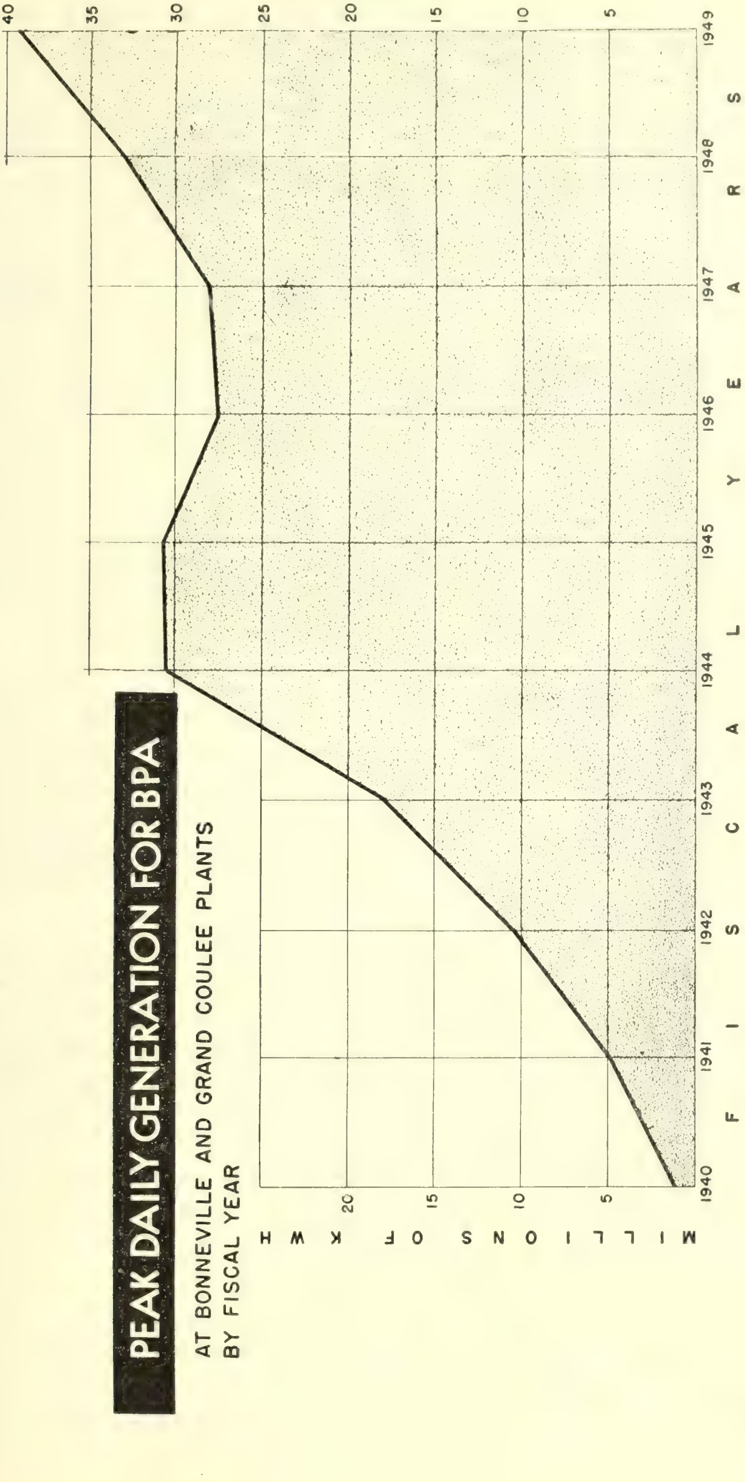
[1] The largest producer of power among private utility systems in the United States was Consolidated Edison Co. of New York, with generation of 11,177,201,000 kilowatt-hours for the calendar year 1948.



ENERGY PRODUCTION

AT BONNEVILLE & GRAND COULEE DAMS
FOR BONNEVILLE POWER ADMINISTRATION



PEAK DAILY GENERATION FOR BPA

AT BONNEVILLE AND GRAND COULEE PLANTS
BY FISCAL YEAR

TABLE 2.—*Bonneville Power Administration electric energy account, fiscal year ended June 30, 1949*

Energy received (megawatt-hours):	
Energy generated for Bonneville Power Administration:	
Bonneville	3,868,558
Grand Coulee	9,057,230
Total	12,925,788
Power purchased and interchanged in	302,950
Total received	13,228,738
Energy delivered (megawatt-hours):	
Sales	11,977,612
Power interchanged out	172,108
Used by Administration	13,881
Total delivered	12,163,601
Energy losses	1,065,137
Percent of total energy received	8.1
Maximum demand on Bonneville and Grand Coulee plants (kilowatts) June 27, 1949, 12–1 p. m., Pacific Standard Time	1,797,000
Load factor—total generated for Bonneville Power Administration	82.1

The tenth generating unit at Grand Coulee, which was the first unit in the right bank powerhouse, was added by the Bureau of Reclamation during May 1949. The addition of this unit brought the total installed generating capacity at the two Columbia River plants to 1,598,400 kilowatts nameplate rating, with safe continuous capacity under favorable operating head conditions of 1,764,000 kilowatts. Three more generators were scheduled for service during July 1949, October 1949, and April 1950.

Chart 3 shows the installed generator capacity at the two plants.

Even with these additional generator installations at Grand Coulee Dam, there will not be enough firm power to relieve the serious deficit. Only by accelerating the construction of new power-producing plants in the region can a dependable supply of power be made available to meet requirements of the Pacific Northwest by 1957–58. Even the most rapid construction, physically possible, of such authorized projects as Hungry Horse, McNary, and Detroit will not meet on a dependable basis the full requirements of cumulative load growth and new industrial uses of power under normal circumstances.

Energy Deliveries

Energy sales by the Bonneville Power Administration during the fiscal year 1949 amounted to almost 12 billion kilowatt-hours and represented an increase of 16.4 percent over the preceding year. Sales during fiscal year 1949 represented 19.2 percent of all power delivered since the beginning of operations.

During the Administration's 11 years' operation ending June 30, 1949, the system delivered 62,337,467,000 kilowatt-hours of energy at a composite average rate of 2.46 mills per kilowatt-hour. Sales to publicly owned utilities for the full period were 7.5 billion kilowatt-hours, at an average rate of 2.75 mills. Privately owned utilities received 16 billion kilowatt-hours at an average rate of 2.42 mills, and industries 38.8 billion kilowatt-hours at an average rate of 2.41 mills.

Aluminum plants established in the Pacific Northwest primarily to meet production needs of World War II, have continued in operation to supply domestic requirements as well as those required for the national security program. Power sales to the aluminum industry over the 11-year period totaled 33.3 billion kilowatt-hours. Total sales to industry other than aluminum, including sales to military establishments, were 5.5 billion kilowatt-hours at an average rate of 3.33 mills.

Electrical energy sales by class of customer for each of the years is shown in table 3.

TABLE 3.—*Electric energy sales by class of customer, fiscal years 1939–49 (megawatt-hours)*

Class of customer	1941 and prior	1942	1943	1944	1945
Industry:					
Aluminum	522, 982	1, 845, 249	3, 588, 848	5, 453, 893	4, 667, 381
Other industry	4, 811	76, 580	464, 309	934, 588	878, 896
Military establishments	18	2, 575	42, 887	87, 889	85, 828
Publicly owned utilities	35, 242	142, 491	435, 289	727, 642	823, 822
Privately owned utilities	536, 555	357, 704	739, 076	1, 467, 304	2, 057, 203
Total	1, 099, 608	2, 424, 599	5, 270, 409	8, 671, 316	8, 513, 130

Class of customer	1946	1947	1948	1949	Total to June 30, 1949
Industry:					
Aluminum	2, 492, 985	4, 212, 413	4, 902, 465	5, 665, 746	33, 351, 962
Other industry	739, 408	600, 131	609, 534	849, 209	5, 157, 466
Military establishments	59, 970	26, 557	37, 379	30, 791	373, 894
Publicly owned utilities	635, 531	1, 045, 199	1, 561, 199	2, 081, 819	7, 488, 647
Privately owned utilities	1, 902, 990	2, 377, 887	3, 176, 732	3, 350, 047	15, 965, 498
Total	5, 830, 884	8, 262, 187	10, 287, 722	11, 977, 612	62, 337, 467

TABLE 4.—*Energy deliveries to customers of the Bonneville Power Administration, fiscal year ended June 30, 1949*

Customers	*Energy deliveries for year* [1] *(kilowatt hours)*
Publicly owned utilities, municipalities:	
Bandon, Oreg	2, 681, 958
Canby, Oreg	5, 635, 800
Cascade Locks, Oreg	6, 739, 200

[1] Includes energy deliveries carried on exchange accounts.

TABLE 4.—*Energy deliveries to customers of the Bonneville Power Administration, fiscal year ended June 30, 1949*—Continued

Customers	*Energy deliveries for year* [1] *(kilowatt hours)*
Publicly owned utilities, municipalities—Continued	
Centralia, Wash	915,000
Cheney, Wash	2,022,900
Drain, Oreg	4,806,000
Ellensburg, Wash	15,977,000
Eugene, Oreg	64,850,709
Forest Grove, Oreg	19,500,000
Grand Coulee, Wash	15,227,280
McMinnville, Oreg	32,132,240
Milton, Oreg	6,717,600
Monmouth, Oreg	5,668,417
Seattle, Wash	164,303,000
Tacoma, Wash	347,995,000
Total municipalities (15)	695,172,104
Public utility districts:	
Benton County public utility district No. 1	51,781,036
Central Lincoln people's utility district	35,212,152
Chelan County public utility district No. 1	109,543,180
Clark County public utility district No. 1	255,456,735
Clatskanie people's utility district	6,937,828
Cowlitz County public utility district No. 1	252,648,434
Douglas County public utility district No. 1	7,473,500
Ferry County public utility district	72,420
Franklin County public utility district	34,234,520
Grant County public utility district No. 2	65,669,612
Grays Harbor County public utility district No. 1	124,351,200
Kittitas County public utility district	3,120,000
Klickitat County public utility district No. 1	22,157,000
Lewis County public utility district	53,703,897
Mason County public utility district	21,405,669
Northern Wasco County people's utility district	172,800
Okanogan County public utility district No. 1	49,291,065
Pacific County public utility district No. 2	37,633,888
Pend Oreille County public utility district No. 1	4,192,345
Skamania County public utility district	10,383,500
Tillamook County people's utility district	3,967,088
Wahkiakum County public utility district No. 1	8,043,600
Total public utility districts (22)	1,157,451,469
Cooperatives:	
Benton-Lincoln Electric Cooperative	16,448,232
Benton Rural Electric Association	14,882,614
Big Bend Electric Cooperative	6,533,726
Blachly-Lane County Electric Cooperative	2,836,400
Central Electric Cooperative	2,559,560
Chelan County Electric Cooperative	402,880
Clearwater Valley L&P Association	13,859,404

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[1] Includes energy deliveries carried on exchange accounts.

TABLE 4.—*Energy deliveries to customers of the Bonneville Power Administration, fiscal year ended June 30, 1949*—Continued

Customers	*Energy deliveries for year* [1] *(kilowatt hours)*
Cooperatives—Continued	
Columbia County REA	6, 244, 800
Coos-Curry Electric Cooperative	4, 347, 000
Douglas Electric Cooperative	10, 777, 600
Eastern Oregon Electric Cooperative	46, 500
Hood River Electric Cooperative	7, 478, 400
Idaho County L&P Association	2, 532, 550
Inland Empire REA	31, 258, 000
Kootenai County REA	8, 103, 390
Lane County Electric Cooperative	12, 327, 685
Lincoln Electric Cooperative	8, 698, 260
Nespelem Valley Electric Cooperative	3, 181, 503
Northeast Clackamas Electric Cooperative	1, 074, 000
Northern Idaho RERA	3, 663, 990
Okanogan County Electric Cooperative	1, 525, 200
Pend Oreille Electric Cooperative	2, 184, 995
Salem Electric Cooperative	21, 282, 200
Stevens County Electric Cooperative	10, 109, 362
Tanner Mutual P&L Association	192, 814
Umatilla Electric Cooperative	9, 653, 844
Wasco Electric Cooperative	9, 316, 609
West Oregon Electric Cooperative	6, 076, 167
Total cooperatives (28)	217, 597, 685
Other:	
Oregon State College	1, 845, 168
Vera irrigation district No. 15	9, 752, 400
Total other (2)	11, 597, 568
Total publicly owned utilities	2, 081, 818, 826
Privately owned utilities:	
B. C. Electric Railway Co.	37, 349, 714
Mountain States Power Co.	143, 727, 719
Pacific Power & Light Co.—Astoria	59, 345, 000
Portland General Electric Co.	1, 114, 926, 000
Puget Sound Power & Light Co.	794, 327, 100
Washington Water Power—Pacific Power & Light Companies	354, 240, 831
Four Company Pool [2]	846, 130, 000
Total privately owned utilities	3, 350, 046, 364
Military establishments (5)	30, 791, 252

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[1] Includes energy deliveries carried on exchange accounts.

[2] Includes Washington Water Power Co., Pacific Power & Light Co., Puget Sound Power & Light Co., Portland General Electrical Co., and Mountain States Power Co., nonfirm energy scheduled to Washington Water Power Co.

TABLE 4.—*Energy deliveries to customers of the Bonneville Power Administration, fiscal year ended June 30, 1949*—Continued

Customers	*Energy deliveries for year*[1] *(kilowatt hours)*
Industries:	
Aluminum:	
Aluminum Company of America	1,401,281,836
Permanente Metals Co:	
Spokane Aluminum Fab	212,358,000
Spokane Aluminum Red.	1,894,084,083
Tacoma Aluminum Red.	386,206,000
Reynolds Metals Co.:	
Longview	554,886,000
Troutdale	1,216,930,000
Other industries:	
Carborundum Co.	23,600
Electro-Metallurgical Co.	133,740,000
Pacific Carbide & Alloys	23,107,600
Pennsylvania Salt Mfg. Co.:	
Plants Nos. 1 and 2	82,329,600
Miscellaneous (10)	610,008,553
Total industries	6,514,955,272
Total sales of electric energy	11,977,611,714

[1] Includes energy deliveries carried on exchange accounts.

At the end of fiscal year 1949, the Administration served 96 wholesale customers, of which 67 were publicly owned utilities or cooperatives, 19 were industrial customers, 4 were military establishments, and 6 were privately owned utilities. Eleven customers were added during the year—1 municipality, 4 public utility districts, 5 cooperatives, and 1 industry. Service to 3 military establishments was discontinued during the year.

The maximum coincident demand of the Administration's system on the Bonneville and Grand Coulee plants was 1,797,000 kilowatts occurring on June 27, after addition of the first unit in the Grand Coulee right powerhouse. This demand represented a 12 percent increase over the system peak during the preceding fiscal year.

Revenues

Gross operating revenues of the Administration for fiscal year 1949 were $27,821,000 exceeding those for the previous year by more than $3,300,000. This is a new high in power sales.

Revenues increased in all customer categories. Sales to aluminum and other industries, including military establishments, increased $1,592,040 or 12.9 percent; to publicly owned and privately owned utilities $1,698,566, or 14.2 percent.

Sales to industries accounted for 50.18 percent of the gross, publicly owned utilities for 21.18 percent, privately owned utilities 27.88 percent, and other electric revenues for 0.76 percent.

Annual Audit

The books and accounts of the Administration were audited for the fifth time by Arthur Anderson & Co. The report confirmed the Administration's records which show a net operating revenue for fiscal year 1949 of more than $10,600,000 after deducting all expenses of operation, maintenance, depreciation and interest. Gross operating revenues from the beginning of operations to June 30, 1949, amounted to $157,600,000 leaving a cumulative net revenue of $42,700,000 as of that date after provision for all expenses, including depreciation and interest on power investment.

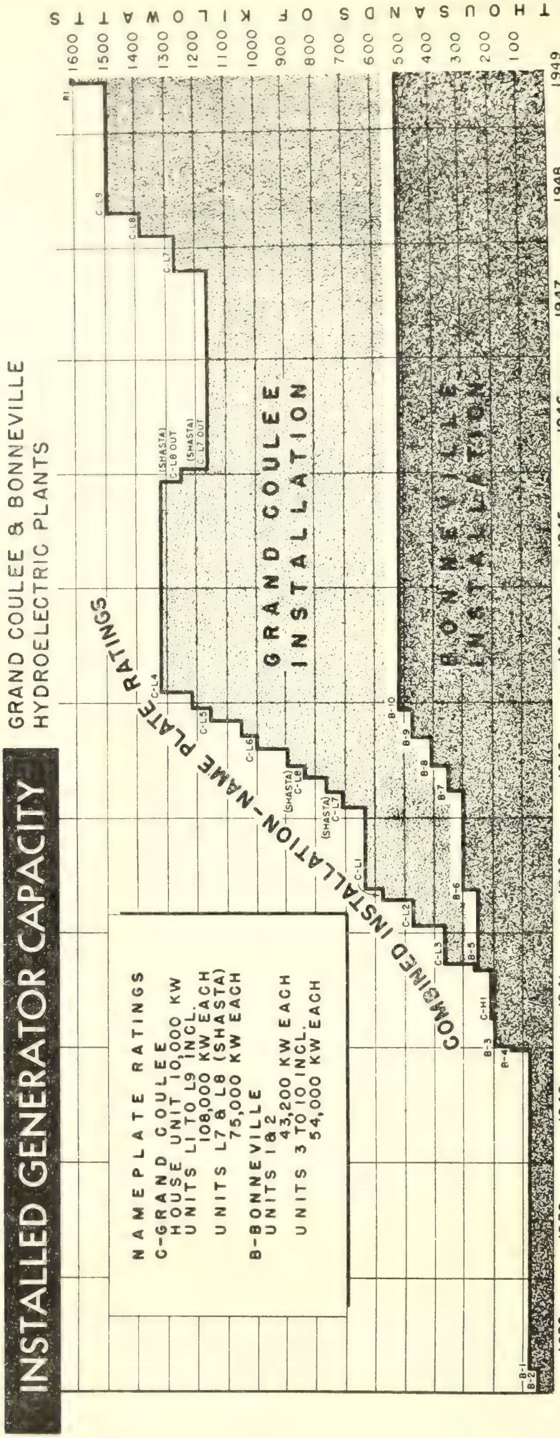
The statements show that the total original construction cost, including interest during construction on power investment of all types of plant, i. e., power, irrigation, navigation, multipurpose, etc., for Columbia Basin project, the Bonneville Dam project and the Administration's transmission system was in excess of $512,000,000 as of June 30, 1949. Of this amount, $358,000,000 was allocated to power, including river regulation, and the remainder, $154,000,000, was allocated to irrigation, navigation, flood control, and other nonpower purposes.

The gross investment of the United States Government in the power phases of the operations of the three projects totaled a little more than $457,000,000 as of June 30, 1949. The Federal investment account as used here includes all funds appropriated and requisitions for both construction and operation, together with indirect items such as WPA expeditures, amounts representing the fair value of property transferred from other Federal agencies, and the gross amount of interest imputed on the unpaid balances of the investment. This interest accumulation alone amounted to more than $62,000,000 as of June 30, 1949.

The gross Federal investment is reduced by repayment of all cash receipts from power operations, inasmuch as the projects cannot retain and use in their operations the amounts collected from power sales with the minor exception of a small emergency fund. The cumulative gross repayments to June 30, 1949, were approximately $149,000,000, leaving a net Federal investment of a little more than $308,000,000 as of June 30, 1949, to be returned from future power operations.

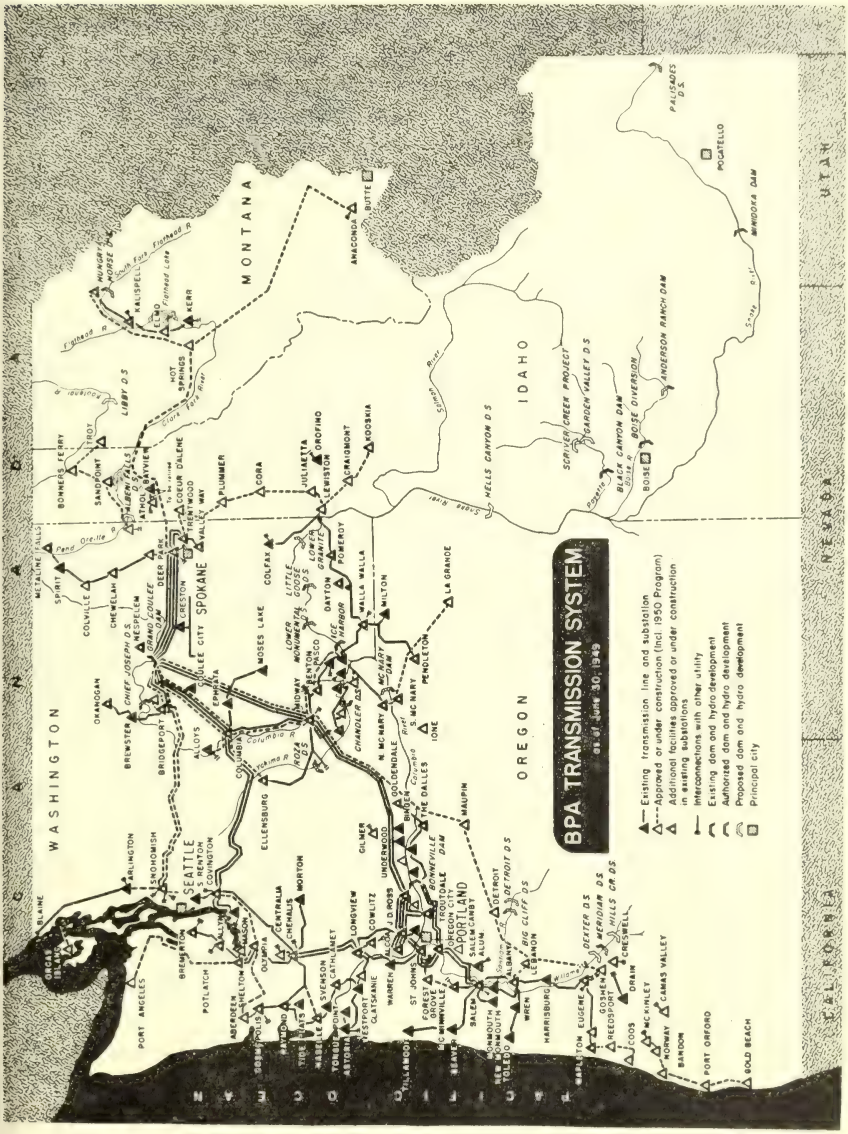
Hoover Commission Report

The Hoover Commission task force report on Revolving Funds and Business Enterprises of the Government stated with respect to the financial statements of the Columbia River power system that the pres-



INSTALLED GENERATOR CAPACITY

GRAND COULEE & BONNEVILLE HYDROELECTRIC PLANTS


BPA TRANSMISSION SYSTEM
as of June 30, 1949
Existing transmission line and substation
Approved or under construction (Incl. 1950 Program)
Additional facilities approved or under construction in existing substations
Interconnections with other utility
Existing dam and hydro development
Authorized dam and hydro development
Proposed dam and hydro development
Principal city
CANADA
WASHINGTON
MONTANA
IDAHO
OREGON
NEVADA
CALIFORNIA
UTAH
PACIFIC OCEAN
SEATTLE
SPOKANE
PORTLAND
GRAND COULEE DAM
BONNEVILLE DAM
MC NARY DAM
HUNGRY HORSE D.S.
HELLS CANYON D.S.
BUTTE
BOISE
POCATELLO

entation of the investment of the Federal Government is considered open to criticism and subject to improvement in two respects, namely:

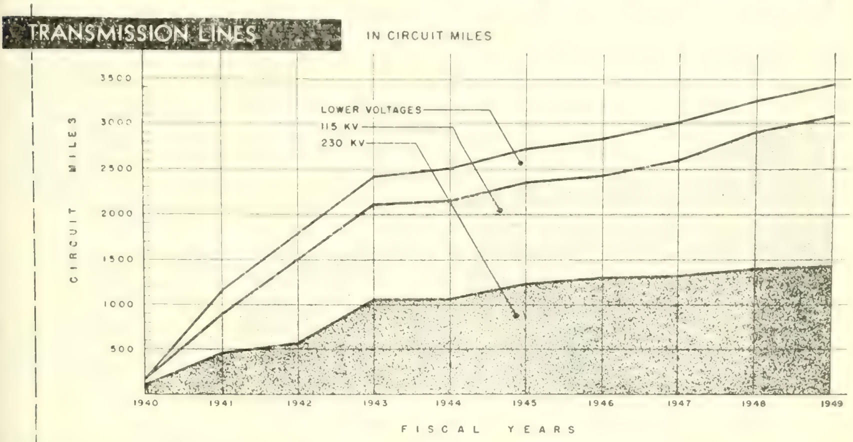
(*a*) The presentation of the gross Federal investment and the gross repayments, both including amounts for current operating and interest expenses, is misleading in that the percentage ratio of the gross repayments to the gross investment might lead the reader to conclude that the project had repaid a greater proportion of the capital investment than is the fact. For example, the gross repayment of $149,000,000 as of June 30, 1949, is approximately 33 percent of the gross investment as of that date. However, a much smaller proportion of the capital investment, more nearly in the neighborhood of 15 percent, has been repaid.

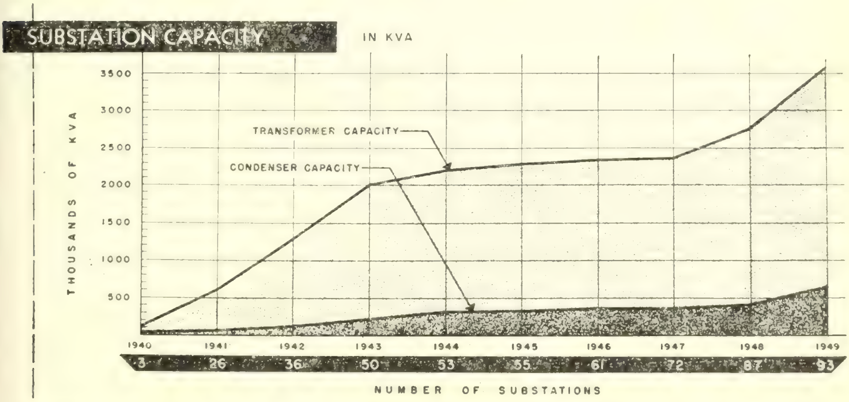
(*b*) Power revenues are required to repay a substantial portion of the investment allocated to irrigation but the financial statements do not indicate the amount of that repayment obligation.

The Administration has been well aware of the first point and has dealt specifically with that problem in its pay-out reports. Unfortunately, the projects must finance both operations and construction from appropriations, unlike a regular business enterprise that would finance operations from revenues. It is not possible to determine accurately from the normal accounting processes a segregation of the Federal investment as between operations on the one hand and construction or capital costs on the other. This arises out of the fact that accounts are kept on an accrued cost basis but the Federal investment account is a cash investment. In our pay-out reports we are able to present an approximation of the break-down of the repayment as between current expenses and capital costs. Such a break-down can be accomplished statistically with sufficient accuracy for the purpose but the break-down cannot be developed directly from the accounts. For example, the operating expenses shown in the certified financial statements include accrued noncash items such as exchange account power purchases, depreciation on equipment used in operations, provision for deferred maintenance, and amortization of loss on abandoned property. The principal noncash items can be identified and eliminated statistically but the many small items cannot. Therefore, we have handled the reporting on this matter in our pay-out reports rather than our certified financial statements.

The second criticism by the task force has also been covered by the Administration's pay-out reports which have discussed and set forth the fact that a substantial portion of costs allocated to irrigation must be repaid from power revenues. This is purely a matter of the requirements of Reclamation law for the repayment of construction costs and is not a part of the cost of power as determined in accordance with the cost accounting system prescribed by the Federal Power Commission. In other words, the power operations will have to show a substantial net return above straight power costs in order to meet the irrigation subsidy repayment obligation. As already noted, the combined net revenues as of June 30, 1949, were more than $42,700,000.

Whether or not the two points noted by the task force are properly matters for treatment in the cost statements of the power phases of the projects' operations is debatable and their past omission should not be a matter of concern inasmuch as they were fully covered by the pay-out reports of the Administration. In any event, however, our auditors have indicated that they will refer to these two points appropriately in their report this year, either by footnote or by the captions used in the financial statements.





Power Rates Encourage Growth

Continuance of the basic wholesale rate of $17.50 per kilowatt-year for Bonneville-Grand Coulee power delivered anywhere from the transmission system has proved very effective in encouraging growth of industries and in insuring wide distribution to residential and commercial customers in the region. Power rates are especially important to industries using electricity at a high load factor and in such quantities as to make it a substantial item in their manufacturing costs. Several optional rates, consistent with the basic $17.50 rate, are available to municipal, cooperative and other public agencies serving primarily residential and commercial loads.

All long-term wholesale power contracts with distributors of Bonneville power contain provisions regarding resale rates and principles of operation to the end that power purchased from the Administration shall be distributed for the benefit of the general public, and particularly of domestic and rural consumers. The direct relationship of increased use of electric energy to the influence of lower rates is well illustrated in table 5. This shows the trends from 1938 to date on an average use and price for residential home and farm service in the Pacific Northwest as compared with the national average.

TABLE 5.—*Residential and rural service—average use per customer and average price per kilowatt-hour*

	United States total	Oregon and Washington		United States total	Oregon and Washington
Kilowatt-hour per customer:			Price per kilowatt-hour:		
1938	902	1,410	1938	[1] 4.02	[1] 2.65
1939	953	1,467	1939	3.87	[1] 2.55
1940	1,006	1,589	1940	3.74	2.27
1941	1,044	1,776	1941	3.65	2.08
1942	1,088	2,024	1942	3.57	1.94
1943	1,135	2,279	1943	3.50	1.84
1944	1,225	2,504	1944	3.41	1.74
1945	1,305	2,801	1945	3.32	1.69
1946	1,418	3,219	1946	3.13	1.58
1947	1,546	3,696	1947	3.00	1.49
1948	1,674	4,160	1948	2.92	1.41

[1] Partially estimated from State commission data.

Source: Edison Electric Institute.

TABLE 6.—*Actual generation by the electric utility systems of the Northwest power pool, fiscal year 1949*

Utilities	Billions of kilowatt-hours	Percent of total generation
Publicly owned:		
Bonneville Power Administration	12.9	54.6
Seattle City Light	1.2	5.1
Tacoma City Light	.8	3.4
Total publicly owned	14.9	63.1
Privately owned:		
Pugent Sound Power & Light Co	1.7	7.2
Washington Water Power Co	1.4	5.9
Pacific Power & Light Co	.6	2.6
Portland General Electric Co	.7	3.0
Montana Power Co	2.5	10.6
Utah Power & Light Co	.8	3.4
Idaho Power Co	1.0	4.2
Total privately owned	8.7	36.9
Total Northwest power pool	23.6	100.0

NOTE.—The above utilities are members of the Northwest power pool. Although British Columbia Electric Co., which serves Vancouver and the surrounding areas in Canada, became a member of the power pool during the fiscal year, figures for this company are not included because data relating only to the area within the United States are believed to be of more interest.

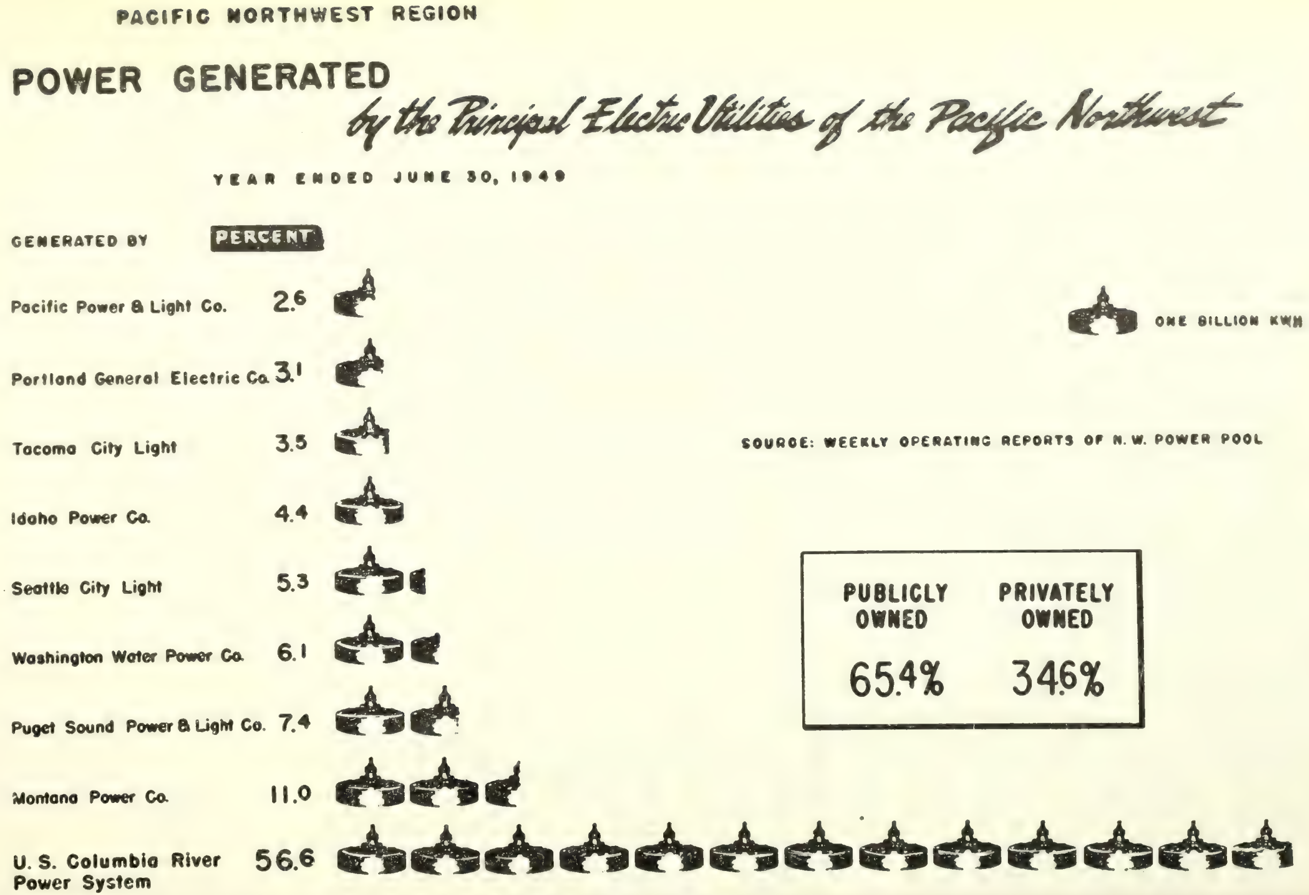
Transmission System

During the 1949 fiscal year, 178 circuit-miles of high-voltage lines and 7 substations were added to the Federal transmission system, comprising a total network of 3,461 circuit miles and 93 substations serving Washington, Oregon, northern Idaho and western Montana. The system has 1,436 miles of 230,000-volt line, 1,678 miles of 115,000-volt line, and 347 miles of lower voltage line.

During the year, 146,125 kilovolt-amperes in substation transformer capacity were added, bringing the total to 2,462,625 kilovolt-amperes under self-cooled conditions and a maximum capacity of 2,969,791 kilovolt-amperes under forced-cooled equipment. An additional 215,380 kilovolt-amperes of static capacitors during the fiscal year bring the total capacity to 337,480, with synchronous condenser capacity remaining the same, or 287,500 kilovolt-amperes.

Numerous customer service substations were energized during the year, the largest single addition being a third transformer bank at Midway Substation. This bank has a self-cooled capacity of 150,000 kilovolt-amperes and a forced-cooled capacity of 250,000 kilovolt-amperes.

Transmission lines to areas where critical power deficits continue or serious distribution problems exist, were given a high priority in the fiscal year's construction program. Important lines energized during the year included the 1.3-mile Columbia-Ellensburg 115,000-volt line, July 8, 1948; the 30-mile Chehalis-Olympia 230,000-volt and the 19-mile Olympia-Shelton 115,000-volt lines, August 5, 1948; Salem-Albany 27-mile 115,000-volt line, December 23, 1948; Eugene-Mapleton 38-mile 115,000-volt line, December 24, 1948; Grandview-Richland 28-mile 115,000-volt line, January 1, 1949; and Franklin-McNary 29-mile 115,000-volt line, May 8, 1949. A 115,000-volt wood-pole line was also completed from Kerr Dam to Hungry Horse Dam to transmit construction power.



PACIFIC NORTHWEST REGION

POWER GENERATED *by the Principal Electric Utilities of the Pacific Northwest*

YEAR ENDED JUNE 30, 1949

SOURCE: WEEKLY OPERATING REPORTS OF N. W. POWER POOL

TABLE 7.—*Generators scheduled for installation in the Pacific Northwest by non-Federal utilities 1950–58—Oregon, Washington, Idaho, and western Montana (thousands of kilowatts)*

	Type of installation	Year	Name-plate rating	Peaking capability
Privately owned utilities:				
Idaho Power Co.:				
Bliss No. 3	Hydro	1950	23.0	23.0
Bliss No. 4	do	1951	23.0	23.0
Guffey	do	1952	30.0	30.0
Plant No. 1	do	1953	65.0	65.0
Plant No. 2	do	1955	70.0	70.0
Plant No. 3	do	1958	80.0	80.0
			291.0	291.0
California-Oregon Power Co.:				
Toketee Falls No. 3	do	1950	13.3	14.2
Slide Creek	do	1951	17.0	17.0
Soda Springs	do	1951	12.0	12.0
Upper Clearwater	do	1952	13.0	13.0
Lower Clearwater	do	1952	15.0	15.0
Fish Creek	do	1952	6.0	6.0
Upper Lemolo	do	1953	20.0	20.0
Lower Lemolo	do	1953	20.0	20.0
			116.3	117.2
Total privately owned utilities			407.3	408.2
Publicly owned utilities (plants):				
Seattle City Light:				
Gorge No. 5	do	1951	60.0	40.0
Ross No. 1	do	1952	90.0	90.0
Ross No. 2, No. 3	do	1953	180.0	180.0
Ross No. 4	do	1954	90.0	90.0
			420.0	400.0
Rock Island,[1] No. 5, No. 6, No. 7	do	1952	60.0	60.0
Rock Island,[1] No. 8, No. 9, No. 10	do	1953	60.0	60.0
			120.0	120.0
Total publicly owned distributors			540.0	520.0
Total all non-Federal utility installations			947.3	928.2

[1] Contingent upon acquisition of this plant by a publicly owned distributor from the Puget Sound Power & Light Co.

TABLE 8.—*Revenues by class of customers through fiscal year 1949*

Class of customers	1944 and prior	1945	1946	1947	1948	1949	Total to June 30, 1949	1949 percentage (dollar revenue)
Industry:								
Aluminum	$24,350,433	$11,838,156	$7,987,226	$9,045,540	$10,453,425	$11,741,530	$75,416,310	42.20
Other industry[1]	5,185,494	4,171,469	3,108,749	1,836,349	1,915,884	2,219,819	18,437,764	7.98
Publicly owned utilities	3,768,642	2,141,635	1,711,822	2,778,765	4,318,120	5,893,436	20,612,420	21.18
Privately owned utilities	7,152,532	4,752,021	5,209,344	6,127,669	7,633,051	7,756,301	38,630,918	27.88
Other electric revenues	130,123	86,737	[2]1,867,144	[3]2,102,606	193,230	209,943	4,589,783	.76
Total operating revenue	40,587,224	22,990,018	19,884,285	21,890,929	24,513,710	27,821,029	[4]157,687,195	100.00

[1] Includes military establishments.

[2] Includes $1,789,443 of contract cancellations applicable to fiscal year 1946. (The total of $3,802,415 was apportioned over a period of 12 months.)

[3] Includes $2,012,972 of contract cancellations applicable to fiscal year 1947. (The total of $3,802,415 was apportioned over a period of 12 months.)

[4] As of June 30, 1949, the Administration had collected and deposited in the United States Treasury power revenue receipts totaling $144,167,008 and general fund receipts of $5,146,044. Accounts receivable, accrued unbilled revenues, unbilled exchange sales, miscellaneous adjustments and minor items accounts for the difference between total revenues and total receipts deposited by the Administration with the United States Treasury.

TABLE 9.—*General specifications—existing, authorized and proposed projects—installations and capabilities correspond to a coordinated system operation of all plants shown*

	Location	Plant installations [1] (kilowatts)	Nominal prime power [2] (average kilowatts)	Pool elevation (feet)	Usable storage (acre-feet)	Average head (feet)	Purpose
Existing projects:							
Grand Coulee	Washington	[3] 1,944,000	[4] 1,549,000	1,288.0	5,212,000	330	Power, irrigation, and navigation.
Bonneville	Washington-Oregon	518,400	479,000	72.0		60	Power and navigation.
Minidoka	Idaho	13,400	6,000	4,245.0	95,200	49	Power and irrigation.
Boise diversion	do	1,500	2,000	2,800.0		31	Do.
Black Canyon	do	8,000	9,000	2,947.0	14,800	94	Do.
Projects under construction:							
Hungry Horse	Montana	285,000	171,000	3,559.0	2,980,000	377	Power, irrigation, navigation, and flood control.
McNary	Washington-Oregon	980,000	627,000	340.0		87	Power and navigation.
Anderson Ranch	Idaho	40,500	7,000	4,196.0	464,200	260	Power, irrigation, and flood control.
Meridian [5]	Oregon	115,000	31,000	929.0	368,000	228	Power, irrigation, navigation, and flood control.
Detroit	do	100,000	31,000	1,569.0	340,000	299	Do.
Big Cliff	do	18,000	9,000	1,197.0		81	Do.
Authorized projects:							
Chief Joseph	Washington	1,152,000	829,000	937.5		171	Power, irrigation, and navigation.
Roza	do	10,000	6,000			140	Power and irrigation.
Chandler	do	12,000	10,000			118	Do.
Palisades	Idaho	112,500	39,000	5,620.0	1,200,000	144	Power, irrigation, and flood control.
Lower Granite	Washington	220,000	158,000	715.0		77	Power and navigation.
Little Goose	do	260,000	195,000	633.0		96	Do.
Lower Monumental	do	240,000	180,000	533.0		89	Do.
Ice Harbor	do	260,000	190,000	440.0		93	Do.
Proposed projects:							
Libby	Montana	588,000	234,000	2,440.0	4,250,000	300	Power and flood control.
Albeni Falls	Idaho	42,600	24,000	2,062.5	1,140,000	24	Power.
Priest Rapids	Washington	1,590,000	733,000	550.0		129	Power, navigation, and flood control.
John Day	Washington-Oregon	1,275,000	720,000	255.0		95	Power and navigation.
The Dalles	do	980,000	691,000	160.0		88	Do.
Hells Canyon	Oregon-Idaho	800,000	640,000	2,077.0	3,880,000	510	Power, navigation, and flood control.
Upper Scriver	Idaho	30,000	21,000	4,505.0		400	Power and irrigation.
Lower Scriver	do	90,000	42,000	4,060.0		794	Do.
Garden Valley	do	60,000	41,000	3,266.0	843,000	280	Power, irrigation, and flood control.
Hills Creek	Oregon	20,000	10,000	1,510.0	221,000	204	Do.
Dexter	do	15,000	10,000	695.0		53	Do.
Cougar	do	25,000	14,000	1,683.0	182,000	418	Power, irrigation, navigation, and flood control.
Green Peter	do	81,000	20,000	984.0	322,000	315	Do.
White Bridge	do	15,000	8,000	670.0		93	Do.

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[1] Name plate ratings.
[2] Average capability during the storage draw-down period.
[3] 12 of ultimate 18 units are now in operation and 6 units are being manufactured.
[4] Pumping requirements of the Columbia Basin project have been deducted.
[5] Power facilities are not authorized.

Construction work was being rushed to completion on two of the most important 230,000-volt circuits in the Federal system, the 166-mile Grand Coulee-Snohomish and the North Bonneville-Troutdale steel tower lines. Both are scheduled for energization in late 1949 to make new generation at Grand Coulee Dam available to major coast load centers in the Puget Sound and lower Columbia areas.

Considerable work was done during the year in technical system improvements to increase carrying capacity and provide more economical transmission. These developments include plans for using 1,272,000 circular-mil steel reinforced aluminum cable on the third Grand Coulee-Columbia line. This is believed to be the largest conductor ever used on 230,000-volt lines. Use of 115,000 and 230,000-volt auto transformers with lower insulation levels instead of the conventional type has made possible substantial increases in capacity at lower cost. Plans for several large synchronous condenser installations incorporate new features that will promote system stability and permit heavier line loadings.

PROBLEMS AND RECOMMENDATIONS

One of the most important problems of the year from a policy standpoint was the need for making a determination as to whether wholesale power rates would have to be increased for the coming 5-year period beginning December 20, 1949. Operations problems, centered primarily in maintaining service with major transmission facilities critically loaded to carry the added generation at Grand Coulee Dam to load centers, and lack of sufficient funds to bring system maintenance up to a status approximating acceptable standards for the industry.

Current Wholesale Rates

The Bonneville Power Administration's wholesale power contracts permit equitable rate adjustments at specified 5-year periods if the Administration has adopted increased wholesale power rate schedules prior to the adjustment date and the national index of wholesale commodity prices for the 6 months preceding such date is 25 percent higher than in specified periods during 1939 or 1945. The current adjustment date is December 20, 1949.

Determination to continue present wholesale rate schedules for another 5-year period is based on extensive studies of construction costs on new facilities and total pay-out requirements. Several years will elapse before substantially increased costs are realized through additions to the Federal power supply and transmission systems. The Administration will also continue to realize surplus revenues for at least 2 or 3 more years under existing wholesale rates.

Financial status of the Administration to date demonstrates that present wholesale rates are paying all costs of power operations in accordance with standard cost accounting principles, including interest and depreciation. Sufficient additional net revenues are being realized to make possible a substantial contribution to the irrigation works of the Columbia Basin project.

Critical Loading of Transmission Lines

Present critical loading of existing high-voltage transmission lines, especially those carrying power from Grand Coulee Dam, continues to harass the Administration and will be a serious problem during the coming 1949–50 winter season. Normal transmission reserves to insure system stability during emergencies would require at least two additional high-voltage circuits on the basis of present loads being carried. Present 230,000-volt circuits from Grand Coulee Dam to Spokane and coast load circuits are each carrying loads up to 220,000 kilowatts, while existing 230,000-volt circuits from Bonneville Dam to Portland load centers are being loaded to approximately 300,000 kilowatts each. An outage on any one of these critically loaded circuits could seriously disrupt power service of large areas.

A comparison of transmission facilities and generation at Grand Coulee Dam 5 years ago and today, graphically illustrates the situation. Six Bonneville power administration 230,000-volt lines carried an average load of 134,000 or a total of 900,000 kilowatts from the 8 generators installed at Grand Coulee Dam in the fall of 1944, to coast areas and Spokane. These loadings were considered a maximum even under wartime conditions. Only one additional 230-kilovolt line, scheduled for completion November 1949, will be available to carry a total generation of 1,440,000 kilowatts when the Twelfth generator is installed at Grand Coulee in October 1949.

To meet even minimum transmission demands in taking power from Grand Coulee Dam, the seven transmission lines will have to carry nearly 70 percent more power than six 230-kilovolt lines carried in 1944. During the coming winter each 230,000-volt circuit will carry an average load of 190,000 kilowatts and from 210,000 to 220,000 kilowatts on key circuits to coastal areas.

Even though the administration has been able to increase carrying capacity of 230-kilovolt lines by almost a third since 1944 through installation of capacitor banks and other technical advances, critical load of the lines will continue to be acute in terms of transmission reserve. One additional 230,000-volt circuit, the North Bonneville-Troutdale line, is scheduled for completion next fall to relieve transmission to Portland, Oreg., load centers.

Scheduled installation of three new generators at Grand Coulee Dam each year until the nine right powerhouse units are installed makes a recognition of the transmission problems imperative if the rapidly increasing load requirements of the Federal system are to be met.

Deferred Maintenance

Maintenance continues to be below the standards necessary for a utility operation of the size and character of Bonneville Power Administration. Appropriations for maintenance have not kept pace with rising costs and growth of the system.

Deferring maintenance not only results in operation hazards that would otherwise be avoided, but is costly in terms of equipment breakdowns that could have been prevented by earlier detection. Deferred maintenance is particularly critical where rapid growth and limited construction appropriations prevent the normal accumulation of reserve capacity in lines and substation equipment. Because present critical loading of lines and equipment makes the effect of any major outage more extensive, the need for keeping maintenance current cannot be too greatly emphasized.

A recent inspection of a synchronous condenser at the Troutdale, Oreg., substation revealed the need for extensive insulation work to avoid electrical failure. Earlier checking might have avoided the necessity for removing the condenser from service for 20 days with repair costs in excess of $12,000. Six other condensers on the system where inspection has not yet been possible may need similar treatment and failure during heavy load periods could result in a loss of over $20,000 a month in power revenue because of the reduction in load carrying capacity. In addition load curtailment may be necessary each time a condenser unit is taken out of service.

Equally costly are transmission line failures where lack of adequate funds for brush clearing and cutting of danger trees on older rights of way are an important factor. Deferment of maintenance on damaged insulators, wood pole cross arms and other transmission items can easily double the cost to the system in the event of severe lightning strikes on the lines. Maximum system stability and economical operation can only be achieved through a program of adequate maintenane.

Summary of Recommendations

Major problems worthy of extended consideration and action by the Congress and the executive branch, in the opinion of the Department, are to a large extent identical with those faced during fiscal year 1948. Essentially they are:

(*a*) Approval of continued system extensions on the major Federal transmission grid in the Columbia Basin, to meet generation scheduled for the remaining units to be installed in the left powerhouse at Grand

Coulee Dam, and to provide reserve capacity for relieving the growing system instability due to overload.

(*b*) Clarification and revision by the Congress of Federal fiscal policies to establish a more flexible and efficient operation of reimbursable public works without weakening controls by the Federal legislature. Further clarification is also imperative in allocation of costs to power and extent of subsidy to irrigation and other purposes, as the basis for rate determinations and advance-operations planning.

(*c*) Importance of a policy that will continue to accelerate the Federal generation in the Pacific Northwest until power supplies meet current needs is mandatory to the welfare of the Columbia Basin. This is particularly true with reference to projects now under construction or authorized.

(*d*) Recognition of the need for a program of operations and maintenance that will recognize the growth of the Federal system, and bring maintenance up to at least minimum standards required by comparable utilities.

TABLE 10.—*Pacific Northwest region*[1]*—estimated potential requirements compared with capabilities of scheduled generating plants, December of each year 1949–58*

[Thousands of kilowatts]

Year	Total regional peak resources [2]	Eestimated peak requirements	Year	Total regional peak resources [2]	Estimated peak requirements
1949	4, 232	4, 259	1954	6, 656	6, 514
1950	4, 683	4, 745	1955	7, 180	6, 955
1951	5, 174	5, 194	1956	7, 810	7, 413
1952	5, 425	5, 643	1957	8, 813	7, 864
1953	6, 045	6, 073	1958	9, 449	8, 317

[1] Including power requirements and resources of all electric utilities, Federal and non-Federal, in the States of Oregon, Washington, Idaho, and Montana west of the Continental Divide.

[2] Assuming minimum-year hydroelectric conditions (year 1936–37) and installation of all currently scheduled additions to generating capacity.

TABLE 11.—*United States Columbia River power system—estimated potential firm power requirements compared with capabilities of scheduled generating plants, 1949–58*

[Thousands of kilowatts]

Operating year	Potential requirements		Capabilities of scheduled plants [1]	
	December peak	Average energy over storage season [2]	December peak	Average energy over storage season [2]
1949–50	2, 031	1, 550	2, 004	1, 303
1950–51	2, 438	1, 822	2, 376	1, 362
1951–52	2, 756	2, 033	2, 736	1, 397
1952–53	3, 049	2, 224	2, 831	1, 594
1953–54	3, 238	2, 382	3, 210	1, 927
1954–55	3, 570	2, 673	3, 712	2, 312
1955–56	4, 000	2, 955	4, 225	2, 705
1956–57	4, 457	3, 238	4, 854	3, 051
1957–58	4, 927	3, 523	5, 876	3, 797
1958–59	5, 348	3, 791	6, 480	4, 541

[1] Based on generator installation schedule S.

[2] Water storage control periods 1949–50 through 1958–59 under minimum hydroelectric conditions.

Southwestern Power Administration

Douglas G. Wright, *Administrator*

DURING the fiscal year 1949, under the authority of section 5 of the Flood Control Act of 1944 and responsibility delegated by the Secretary of the Interior, the Southwestern Power Administration continued its functions of constructing transmission facilities and distributing and marketing hydroelectric power and energy generated at the multiple-purpose reservoir projects built and operated by the United States Army in the area served by this Administration.

Major activities were the construction of transmission facilities authorized by the 1947 and 1948 appropriations for this Administration, the administering of power and energy sales from the Norfolk and Denison plants, negotiation of contracts with cooperatives and public bodies, and practically continuous negotiations with the private utilities for a satisfactory and equitable contract of integration.

Congressional appropriation for this Administration for the fiscal year 1949 provided only for operation and maintenance and for engineering and supervision of the construction under contracts executed prior to June 30, 1948; no additional transmission facilities were authorized. However, in the latter part of the year, the President approved a $37,500,000 program to construct additional lines and substations to bring low-cost Federal power and energy to load centers of preferred customers and to connect future hydroelectric projects to the Southwestern Power Administration system. In line with this, for the fiscal year 1950, the House appropriated $4,000,000 cash for construction and operation and maintenance, $5,000,000 for contract authorization, and increased the continuing fund from $100,000 to $300,000.

The appropriation bill for fiscal year 1950 was pending in the Senate at the close of fiscal year 1949.

NORFORK DAM PROJECT

This project, located on the North Fork River—a tributary of the White River in Arkansas—was designed and built by the United States Army, and is being operated by them. The first of a possible ultimate of four 35,000-kilowatt generating units has been in commercial operation since March 6, 1945, and the second 35,000-kilowatt unit is expected to be ready for commercial operation during the last quarter of the calendar year 1949.

Revenues from the sale of the electric power and energy generated at the Norfork project during the fiscal year 1949 were $865,184.18 and were deposited in the United States Treasury.

DENISON DAM PROJECT

The Denison Dam project, also designed, built, and being operated by the United States Army, is located near Denison, Tex., on the Red River and the Texas-Oklahoma border. It is designed for a possible ultimate of five 35,000-kilowatt generating units. The first unit has been in operation since March 9, 1945, and the second unit is scheduled for completion and commercial operation during the third quarter of the calendar year 1949.

Revenues from the sales of the electric power and energy generated at the Denison Dam and sold to two private utilities and six rural electric cooperatives for the fiscal year 1949 were $795,948, which amount was deposited in the United States Treasury.

CONSTRUCTION

Construction work contracted for under the 1947 and 1948 appropriations was continued during the fiscal year 1949. The 11 contracts covered approximately 259 miles of 154-kilovolt and 114 miles of 132-kilovolt transmission line connecting the Norfolk and Denison projects, approximately 134 miles of 66-kilovolt feeder transmission lines and a 154/132-kilovolt substation located near Weleetka, Okla. There were completed in the fiscal year 1949 approximately 44 miles of 66-kilovolt line, 20 miles of 132-kilovolt line, and 51 miles of 154-kilovolt line. All of the balance is anticipated to be completed by the last quarter of the calendar year 1949.

These facilities connect the Denison and Norfork generating plants and give two 66-kilovolt outlets to transmit and dispose to preferred customers the electric power and energy from these Federal hydroelectric projects, whose present capacity is 70,000 kilowatts.

The second generating units at both of these plants, and the two units at the Narrows project, will be in operation in 1950 and will increase the amount of power to be sold by this Administration to 157,000 kilowatts. Additional outlets will be needed to dispose of this power, and funds have been requested to build them.

The total Federal hydroelectric capacity in this area from projects now in operation, being constructed, and authorized is 903,900 kilowatts.

The United States Army is constructing six more multiple-purpose dams in this area, with a total generating capacity of 294,000 kilowatts. All of these plants, with a total capacity of 451,000 kilowatts, are expected to be in operation in 1953, and this Administration has requested funds to start building the facilities necessary to interconnect these new units with the present system and to dispose of the additional power.

Further, six additional dams have been authorized and several more generating units will be installed in operating plants to bring them to capacity.

MARKETING

Continued, but unsuccessful efforts, were made during the year to reach agreement with the private utilities for interconnection and integration of facilities.

One new cooperative and several new delivery points to old customers were connected to the Texas Power & Light System under the contract between that company and the Administration.

A contract has been made with the Brazos River Transmission Electric Cooperative for the delivery of power to the co-op from the Texas Power & Light System. Initial delivery of 6,000 kilowatts and ultimate of 10,000 kilowatts will start as soon as the necessary transmission facilities are completed. Another contract with Brazos River Transmission Electric Cooperative covers purchase, by the cooperative, of the full capacity of Whitney Dam. This project, which is scheduled for completion in 1952, will have 30,000-kilowatt installed capacity.

Several other contracts were executed with rural electric cooperatives under which service will start as soon as interconnection facilities can be obtained.

LOOKING FORWARD

The calendar year 1949 will see completed the construction initiated as a result of the appropriations for fiscal year 1947 and 1948. This will give this Administration approximately 373 miles of 154/132-kilovolt transmission line and the substation connecting the Norfork and Denison Dam projects, and approximately 134 miles of 66-kilovolt feeder lines in Arkansas, Missouri, and Oklahoma.

Since no provision was made in the appropriation for the fiscal year 1949 for necessary equipment and tools to operate and maintain completed facilities, this work had to be delayed until provision could be made in the 1950 fiscal year appropriation. This has been a serious handicap, as field organizations should have been established with the necessary personnel, equipment, and tools. When this is authorized it is planned to create a field headquarters at Muskogee, Okla., at approximately the geographical center of operations and to establish outlying depots with crews, equipment, and tools to handle various sections of the system.

It is well recognized that to obtain the maximum benefit from hydroelectric generating plants in the area, they must be integrated with fuel-burning generating plants in the area, and this can only be accomplished by: (1) Interchange contracts with private utilities, cooperatives, public bodies, or industrial establishments having fuel-burning generating equipment; (2) Federal purchase of electrical energy generated by others; (3) Federal sale of all its hydroelectric energy to the private utilities or others having fuel-burning generating capacity with which it can be integrated; or (4) Federal construction of fuel-burning generating plants. It is believed the first method would be the most beneficial to the Government, the companies, and the customers of both systems.

Regardless of whether the Government obtains fuel-burning capacity by construction or by contract, it will be necessary to interconnect the generating facilities of hydroelectric projects in the area as they near completion. This will require the construction of additional transmission facilities unless interchange and integration contracts can be consummated to provide for the use of privately owned transmission facilities by the Government where such facilities exist.

Bureau of Mines

James Boyd, *Director*

FOREWORD

SAFEGUARDING America's precious mineral heritage through conservation and more effective utilization and promoting maximum safety and efficiency in the domestic minerals industries were the major objectives of a many-sided program of exploration, research, and safety education carried on by the Bureau of Mines last year. Although these goals had been traditional with the Bureau since its organization nearly four decades ago, a growing need for strengthened national security in a troubled world, as well as the responsibilities of international leadership, gave added impetus to the Bureau's activities during the year.

Two World Wars had taken a heavy toll of the Nation's rich mineral reserves. But the continuing heavy demands of an expanding domestic economy and large-scale foreign requirements further strained the country's already depleted resources. To meet this challenge, the Bureau, through a corps of highly trained personnel, worked unceasingly on the problems of producing superior products from increasingly leaner ores, adding to the known reserves of mineral fuels, both natural and synthetic, and protecting the lives of workers in all branches of the minerals industries.

Throughout the Nation, in quiet laboratories, in pilot plants, and in the field—the latter frequently under adverse conditions of climate and terrain—the undramatic but vital struggle to assure the country's economic future continued. And while immediate objectives were not always attained, much valuable information was accumulated which would be useful in the solution of future problems.

To help expand domestic mineral frontiers, Bureau engineers carried out 44 development projects, of which 17 added substantially to known reserves of critical and essential minerals. As a part of its program for "taking stock" of the Nation's mineral resources, the Bureau established three additional core libraries, bringing the total to seven. Collected during governmental and private investigations, these drill cores, along with geologic and mine maps and core-drill data, are becoming increasingly important mineral reference libraries. In Alaska, America's strategic northernmost Territory, the Bureau broadened its mineral development program.

Traditionally interested in the development of efficient mining techniques, the Bureau made available to industry much valuable information in this field. In experimental mining studies, special emphasis was placed on the exploitation of marginal and low-grade deposits of such strategic minerals as chromite, manganese, and vanadium. Bureau scientists also developed and applied physical theory in the solution of the roof-sag and blasting problems with effective results.

To help reduce the dependence of the United States on foreign manganese, the Bureau intensified its investigation of domestic sources of this essential component of steel. In cooperation with the American Iron and Steel Institute, a program was initiated in search of a technically feasible method of extracting manganese from open-hearth slags. In another effort to replace foreign ore, battery-grade manganese was produced in cooperation with the Signal Corps on a small test-plant scale. Meanwhile, studies of metallurgical and mechanical processes for upgrading domestic chrome ores and research on the beneficiation of low-grade iron-ore taconites and titaniferous magnetites were continued.

Studies of nonferrous metals were pushed vigorously, and Bureau metallurgists produced a magnesium-manganese-nickel alloy possessing a higher tensile strength per square inch than that reported for the strongest commercial alloys of this type. Investigations looking toward the economic processing of oxidized copper ores and improving the deposition of zinc by electrolysis also made substantial headway. The Bureau-developed metal titanium—a highly desirable construction material because of its lightness, strength, and resistance to corrosion—was brought closer to the point of commercial application, while the development of ductile zirconium, another new metal offering many promising possibilities, advanced to the pilot-plant stage. Continuing its research on improved methods of gold and silver recovery, the Bureau, in cooperation with the Atomic Energy Commission, also investigated the production of uranium and vanadium from a large group of domestic ores. Of benefit to the armed forces and to the electrical industry were the Bureau's studies in the development of synthetic mica. Successful completion of these investigations may help to relieve the domestic shortage of this essential insulating material.

Recognizing that America's strength and economic well-being depend in large measure upon ample supplies of fuels, the Bureau again directed its efforts toward assuring adequate reserves of all types of fuels, including special-purpose coals, petroleum, and natural gas.

Serious depletion of metallurgical-grade coking coals gave special significance to the Bureau's program for upgrading coals for use, alone or in blends, in producing metallurgical coke, and to the search for new reserves of coking coal. As part of this same effort, the new methods of increasing the utilization of large deposits of lignite and subbituminous coal were studed; and at Schuylkill Haven, Pa., and at Grand Forks, N. Dak., new laboratory facilities for anthracite and lignite neared completion. A Bureau-developed process for the high-speed drying of lignite was successfully employed in pilot-plant tests, and the new technique may provide a wider geographic market for this fuel.

Studies aimed at raising the output of bituminous coal and anthracite through the use of specially designed machinery also formed a part of the Bureau's coal-research pattern, which included investigations of improved methods of recovering fine coal previously lost in washing and work on coal combustion.

Spurred by a declining rate of discovery of new oil reserves and the mounting requirements of America's oil-thirsty industry, the Bureau drove closer to its goal of developing commercially usable processes for producing synthetic liquid fuels from coal and oil shale. With the dedication of two new coal-to-oil demonstration plants at Louisiana, Mo., the Bureau brought to a successful climax its pioneer work in this vital field. The new plants, completely modern and incorporating the latest features, may provide the basis for an industry which may eventually make America self-sufficient in oil. At Bruceton, Pa., and Morgantown, W. Va., significant progress was made in developing cheaper and more efficient methods of producing synthetic gas, an important cost item in the manufacture of oil from coal. The high cost of mining oil shale, long a major barrier to the utilization of this vast potential oil reserve, was substantially reduced at the Rifle, Colo., experimental mine by completely mechanizing operations, and studies at the nearby laboratory further proved the feasibility of extracting oil from shale. Facilities at Rifle were also expanded by the establishment of the Nation's first continuous shale-oil refinery, while experimental studies at Laramie, Wyo., provided valuable information on the processing of shale oil.

Searching for new reserves of petroleum, the Bureau studied improved secondary methods of increasing the recovery of oil from established fields in Texas, Oklahoma, and Colorado. In addition, Bureau scientists investigated the protective value of various chemical compounds in reducing the corrosion of equipment in high-pressure gas-condensate wells, studied the development of an effective process for recovering hydrocarbons from bituminous sandstones in California and Utah, and continued their research in Diesel fuels. Helium gas of

99.9 percent purity was produced at Exell, Tex., and a substantial percentage was distributed for commercial and medical uses.

Pledged to the protection of the life and health of America's irreplaceable human resources—the millions of workers in the Nation's minerals industries—the Bureau last year intensified its safety campaign based on: (1) Research and investigation, (2) safety education and training, and (3) inspection. That workmen and officials in the coal industry are becoming increasingly safety conscious is evidenced by the fact that coal-mine fatalities per million tons of coal mined declined to the lowest average in the recorded history of the industry, while safety advances were made in many other segments of the minerals industries.

Because of the wide variety of safety problems confronting the minerals industries, the Bureau's research and investigation activities in this field covered a similarly wide range. In combating the hazards of falling rock in mines—largest single cause of deaths and injuries in underground mines—the Bureau adapted to coal-mine use a suspension-type support used in some metal mines. Thousands of dust and air samples were analyzed and recommendations offered for reducing hazards. Certificates of approval were awarded electrical equipment and component parts designed for use in gassy coal mines after they successfully met the Bureau's rigid "permissibility" tests, which are respected throughout the minerals industries. Mine operators again utilized the Bureau's extensive experience in mine and tunnel ventilation in the solution of specific problems. To help reduce respiratory hazards in coal mines, field studies were made to determine the effects of silica dust on workmen exposed to this hazard, and research was continued on the development of effective emergency mine communications apparatus. Development of new and improved methods of dispersing rock dust to help prevent coal-dust explosions represented an important advance in coal-mine safety.

Recognizing that the value of a safety program depends largely upon its complete acceptance by employees and officials, the Bureau continued its efforts to widen the scope of its safety-education activities. In addition to training thousands of supervisory officials in the principles of coal-mine safety, the Bureau familiarized mine-safety committeemen with established safety standards to assure closer cooperation with management in reducing hazards. As during previous years, courses in first aid, mine rescue, and accident prevention were given to workers in mines and plants, and the Bureau continued to work closely with local chapters of the Joseph A. Holmes Safety Association and presented awards for outstanding safety achievements to plants and individuals.

Under authorization of the Coal-Mine Inspection and Investigation

Act of 1941, more than 6,670 coal-mine inspections were made—the largest number since the establishment of the Federal inspection program. Results of these investigations were made available to mine operators, mine workers' organizations, and the public. Although the program is purely voluntary, it has been an important factor in correcting some of the more hazardous conditions and practices in the Nation's coal mines. Other factors contributing to the more optimistic safety outlook in the coal industry are intensification of State and Federal safety-education programs and acceptance of Federal safety standards for bituminous-coal and anthracite mining in contracts between operators and employees.

Reappraisal of America's mineral resources in the light of rising domestic requirements and large-scale foreign commitments was the goal of most of the Bureau's statistical services. Throughout the year, the Bureau was called upon by Government and industry to furnish information pertinent to national-defense planning, foreign relief and rehabilitation, and mine-safety progress. Among the agencies served were the Economic Cooperation Administration, the National Security Resources Board, and the Munitions Board. In spite of these unusual demands, the Bureau continued most of its normal statistical coverage of the production, distribution, and consumption in all phases of the minerals industries.

Making available to industry, Government, and the public the results of technologic, scientific, and economic research, the Bureau released a large volume of all types of publications. However, in the interest of economy, only limited numbers of each publication were printed.

Bureau of Mines educational films last year were exhibited before an audience of 17,453,423 persons, the largest number in the history of this unique program. Financed by private industry and produced under the supervision of the Bureau, the films show the uses and methods of producing various mineral commodities. They are available for free showings before business and civic groups, scientific associations, colleges, and other organizations.

MINERAL DEVELOPMENT

Through laboratory research, with pick and shovel, and in pilot-plant tests, the Bureau continued its efforts to determine the Nation's mineral potential and to increase it through advanced technology. Always in view were the twin goals of conservation and national security.

Mine examinations, development projects, experimental mines, equipment design and testing, mathematical analyses and model studies, and a variety of other procedures contributed to greater knowledge and new invention in the minerals field. The Nation's known reserves of strategic and essential minerals were increased substantially. Preparations were made to expand knowledge of the mineral resources of Alaska and give greater service to the Territory's mineral industries as construction of a mining experiment station at Juneau got under way.

The Bureau's mining engineers and metallurgists cooperated to assure the Nation an adequate supply of manganese, spurred on by curtailment of shipments from the Soviet Union. Engineers began a thorough investigation of a large deposit in Maine and drafted plans for a similar project in Arizona. Metallurgists, while preparing to seek effective and economical methods of treating these ores, began a cooperative search with the American Iron and Steel Institute for a method of recovering manganese from open-hearth slags. They also undertook fundamental research to determine the role of manganese in steel.

Studies of nonferrous metals were responsible for the production of a magnesium-manganese-nickel alloy stronger than any hitherto reported and yielded progress toward utilization of oxidized copper ores. Meanwhile, in the field of new and light metals, one Bureau-developed metal, ductile titanium, reached the threshold of commercial development and pilot-plant production. Another, ductile zirconium, was stepped up to increase the supply available for research. As the year closed, the Bureau prepared to penetrate the entire field of titanium alloys as rapidly as available funds permit. Each of these metals has special physical and chemical qualities that make it valuable to the armed forces, the Atomic Energy Commission, and private industry. Titanium, because it is the fourth most abundant metallic element in the earth's crust, promises to replace a number of critical structural metals as improved techniques bring down production costs and desirable alloys are developed.

In many other fields, Bureau engineers and metallurgists sought ways to utilize more fully those mineral resources that are found in abundance, to develop substitutes for those that are scarce, and to synthesize those that cannot otherwise be produced in this country.

MINING ACTIVITIES

Investigation of mineral deposits.—Continued investigation of domestic mineral deposits yielded information of great value in terms of future prosperity and security. This program was devoted chiefly to critical and essential commodities, to noncommercial or marginal deposits, and to those believed to have national significance. Its benefits will be reaped years hence or in time of emergency; it is neither desired nor expected to reduce the need for development of today's ores by private industry.

Of 44 development projects under way during the year, 17 added substantially to known reserves of critical and essential minerals. Included were approximately 4,300,000 tons of low-grade copper ore, with a gross copper content of about 46,000 tons; 1,200,000 tons of lead-zinc ores, with a gross metal content of 101,000 tons; 1,100,000 tons of low-grade graphite ore; 200,000 tons of good-quality gypsum (in Alaska); 34,200 tons containing 2,000 flasks of mercury; 260,000 tons of talc; several million tons of low-grade rutile-bearing ore; and small tonnages of ilmenite, tin, tungsten, and nickel-copper ore. These investigations involved 65,820 feet of diamond, churn, and other drilling; 25,000 feet of trenching; 235 feet of shaft, drift, and crosscut; nearly 8 miles of access roads and trials; many hundreds of channel and drill samples taken and analyzed; and a number of metallurgical tests to determine possible mineral recoveries and quality of products. Information obtained from these and earlier projects was published as rapidly as possible for the benefit of the mineral industries.

The Alaskan staff of the Bureau was increased during the year to handle an enlarged minerals-development program in the Territory, and at Juneau construction began on a building to provide office, laboratory, and shop facilities as the start of a new mining experiment station. Examination of mines and prospects designed eventually to provide a reasonably complete appraisal of the Territory's mineral resources was centered in southeastern Alaska. The immediate importance of construction materials in the Territory led to the examination and development of gypsum, limestone, and shale deposits.

The monazite content of various western gold placer deposits was investigated for the Atomic Energy Commission.

Construction during the year of three more core-storage warehouses or libraries brought the total to seven, situated at Fairbanks, Alaska; Albany, Oreg.; Reno, Nev.; Salt Lake City, Utah; Tucson, Ariz.; Rolla, Mo.; and Bluemont (Mount Weather), Va. These permanent collections of drill cores from Government and private investigations become more useful yearly.

Bureau engineers made 755 field examinations during the year. These not only indicate eventual development and utilization of the more promising deposits but help in evaluating the national critical and essential mineral situation and the local industrial mineral potential of specific areas.

Experimental studies.—Experimental mining projects included one in the Montana chromite district, one on a vanadiferous phosphate deposit in Idaho, one on the southern Wisconsin shallow lead deposits, and one on an eastern pegmatite deposit.

Plans were drawn up for development and metallurgical research on two of the major domestic manganese deposits, one in Aroostook County, Maine, and the other in Mojave County, Ariz. Preparatory work began on the former. Reserves in these deposits are large enough to justify strenuous efforts to overcome technical difficulties that now prevent their exploitation.

While driving a necessary ventilation raise at the Mount Weather, Va., experimental adit, the Bureau studied the possible underground applications of the millisecond, delay, electric blasting cap recently developed by explosives manufacturers and used to some extent in quarrying. As the unexpected result of an unconventional hook-up followed by a series of confirming tests, it appears that under some conditions the cut holes can be eliminated from blasting rounds with a considerable saving in drill footage and explosives cost.

Dynamic strain analysis was emphasized in research on the application of physics to mining. As a result of the invention of gages that make it possible to measure dynamic strains in a solid body of rock, progress was made in solving fundamental problems of generation and preparation of strain waves and breaking rock by explosives. The instruments and techniques are being used experimentally in shooting oil wells and in dam-construction blasting—the latter in connection with the Missouri River dams at Picktown and Pierre, S. Dak.

Research on static stress analysis was continued in the Bureau's experimental oil-shale mine at Rifle, Colo., where the results are applied directly to the mining program. Strain gages, microseismic recorders, photoelastic and other model studies, physical-property determinations, and mathematical analyses make it possible to evaluate stresses met in room-and-pillar mining, thus suggesting preferred development lay-outs.

An experimental diamond-drilling project, undertaken in cooperation with the Geological Survey, paved the way for obtaining good core recovery in the southeastern Idaho phosphate-rock formations. Difficulties formerly encountered in drill-sampling these important phosphate reserves were at least partly overcome.

Mining-method reports.—Eleven reports prepared by Bureau engineers on outstanding developments in mining methods and equipment were made available to the industry during the year. These reports, prepared in cooperation with mining companies, are designed to encourage the rapid adoption of improved methods. Often, they include information about operating costs.

Missouri Basin studies.—Numerous investigations on behalf of the Missouri Basin program were in progress during the year, and 28 reports were made available to the field committee. These covered a wide range of mineral commodities and related industrial problems.

METALLURGICAL ACTIVITIES

Ferrous metals.—The curtailment of shipments of manganese ore by the Union of Soviet Socialist Republics early in 1949 led the Bureau to begin more investigations of domestic sources of this essential ingredient of steel. In cooperation with the American Iron and Steel Institute, a program was initiated in search of a technically feasible method of extracting manganese from open-hearth slags. These average about 8 percent manganese, and their volume is so great that they constitute a source of the metal more than adequate to compensate for the supplies formerly obtained from Russia. In an effort to reduce the need for manganese, fundamental studies of its role in steel were initiated. In addition, research on the utilization of domestic manganese ore deposits is being intensified.

In another effort to replace foreign ore, battery-grade manganese dioxide is being produced in cooperation with the Signal Corps on a small test-plant scale. An excellent-grade product can be made by electrodeposition of manganese oxide on graphite anodes. However, it is necessary to investigate other anode materials, owing to the rapid deterioration of graphite.

Studies of metallurgical and mechanical processes for upgrading domestic chrome ores are in progress. One that selectively reduces the iron and magnesium content of chromite has proved successful with some ores.

Research on beneficiation of low-grade iron ores, including taconites and titaniferous magnetites, to make them usable was continued. Studies on the effects and control of sulfur in iron also are in progress.

Nonferrous metals.—During an investigation of the magnesium-manganese-nickel system, an alloy was produced that has a tensile strength 5,000 to 7,000 pounds per square inch higher than that reported for the strongest commercial alloys of this type.

In cooperation with the Navy, copper-manganese alloys are being prepared for fabrication into turbine reduction gears. The primary purpose is to lower noise level and reduce the transmission of vibration.

Substantial progress was made during the year in an investigation looking toward the economic processing of oxidized copper ores and in another aimed at improving the deposition of zinc by electrolysis.

New and light metals.—During the year the Bureau produced 5,600 pounds of ductile titanium for experimental purposes. This new Bureau-developed light metal—a highly desirable construction material because of its abundance as a natural resource, its most favorable weight-strength ratio, and its marked resistance to sea-water, atmospheric, and other chemical corrosion—has reached the threshold of commercial development. One company, already turning it out at the rate of 300 pounds a day, is stepping up its production, and several others are keenly interested in producing the metal. Still other companies are mastering the technique of rolling and fabricating titanium.

The development of such a metal opens a broad field for further research. The present production process should be improved so as to reduce costs, much additional information on corrosion resistance is needed, and the entire range of titanium alloys remains to be explored. There is the possibility of developing new alloys with superior properties.

In addition, several research projects are under way on the beneficiation of titanium ores and the production of titanium dioxide or chloride intermediates in manufacturing the metal. One method utilizes titaniferous magnetite and produces titanium dioxide while recovering iron and vanadium as byproducts. Another depends on the chlorination of titanium mattes.

Bureau development of ductile zirconium, another new metal, has advanced to a pilot-plant production of about 300 pounds a week, all of which is being used in research. Like titanium, zirconium has special physical and chemical properties that make it interesting to the armed forces, the Atomic Energy Commission, and private industry. Pilot-plant operations produced 2,700 pounds of the metal during the year. Future research will be directed toward process improvement, the development of alloys, and the study of their physical and chemical properties.

Abrasive-grade bauxite is being produced commercially by a process of roasting and magnetic separation. The Bureau recently attempted to produce an abrasive-grade product by crushing and tabling raw Arkansas bauxite, but the pilot-plant test showed that this method does not compete commercially with present plant practice. A procedure is now being investigated that utilizes a two-stage roast, by which an abrasive-grade product, a Bayer-grade (metallurgical) bauxite, and an iron concentrate are obtained.

Rare and precious metals.—During investigations concerned with gold and silver recovery, the simultaneous extraction and electrolytic deposition of gold from activated carbon was demonstrated to be commercially feasible.

In cooperation with the Atomic Energy Commission, substantial progress was made in a program that has as its primary objective the determination of optimum conditions for the recovery of uranium and vanadium on a commercial scale from a wide variety of domestic ores.

Nonmetallic minerals and their products.—Investigations on the production of synthetic mica were continued in cooperation with the Army and Navy. Crystals up to an inch in diameter have been produced. They have excellent transparency, cleavability, and flexibility.

However, much larger single crystals are the goal. As a byproduct of this investigation, a ceramic body consisting of a polygranular synthetic fluorine mica has been prepared. This product is expected to be useful for electrical insulation, and as such it is a possible substitute for block talc. Bodies of the material can be machined.

The Benjamin Franklin graphite mines at Chester Springs, Pa., were operated under contract, and 7.5 tons of flake graphite was produced. This is to be used in tests to determine the acceptability of domestic graphite for crucibles and allied bodies.

Considerable progress has been made in the development of a commercial method for the production of high-grade aluminum silicate (mullite) refractories from domestic sources to replace foreign material.

Substitutes for industrial diamonds are being sought through the synthesis of hard materials.

Miscellaneous.—In addition to the specific problems mentioned, the Bureau's metallurgical activities include many other diversified research projects and services. As an aid to the mining industry, field laboratories identified or analyzed for radioactivity several thousand rocks and minerals for prospectors, ran hundreds of concentration tests on local ores, conducted fundamental studies on electrostatic separation, carried on the highly important project of determining the thermodynamic properties of metallurgical substances, and further investigated methods for treating and recovering waste metals.

FUELS AND EXPLOSIVES

A far-reaching program of fuel development and research—designed to assure the Nation enough fuel supplies for future needs while promoting maximum safety and conservation—was conducted by the Bureau last year.

To help improve the metallurgical coking coals situation, the Bureau embarked on a survey to determine known minable reserves, upgraded marginal coking coals, and conducted blending studies to use noncoking or poorly coking coals. Increased laboratory facilities for anthracite and lignite research approached actuality at Schuylkill Haven, Pa., and at Grand Forks, N. Dak. New, improved methods of dispersing rock dust in coal mines to prevent the spread of coal-dust explosions were developed.

Synthetic liquid fuels research forecast eventual freedom from dependence upon imported oil supplies, as two new coal-to-oil demonstration plants at Louisiana, Mo., were dedicated. Low-cost volume production, coupled with advances in retorting and refining techniques, placed the production of oil from shale in a competitive position with other sources of liquid fuels. Petroleum studies yielded information that will mean many more million barrels of oil recovered. Helium production took another step forward, as the purity of the gas was increased to 99.9 percent. The use of unsafe black powder in coal mines dropped to 16 percent of all explosives employed.

COAL AND COAL PRODUCTS

Coal mining and investigations.—An investigation to determine known minable reserves of coking coals was well under way in seven Pennsylvania counties, eight southern West Virginia counties, and eight eastern Kentucky counties. Bureau studies to increase coal output through the use of mechanical equipment were made in bituminous-coal mines in Arkansas, Pennsylvania, West Virginia, and Wyoming. In Pennsylvania anthracite fields, shearing machines for recovering pillars from thick beds and a machine for pneumatically stowing mine waste into roof-supporting pillars and barriers were tested. Progress also was made in constructing a vibrating-blade coal planer, designed to "plow" coal from the face without drilling or blasting.

Coal deposits in south central Alaska and the Kenai Peninsula were investigated, and core drilling was conducted in the Matanuska field. In Gunnison County, Colo., an investigation disclosed recoverable coal reserves estimated at 624,800,000 tons, but unsuitable for present-day metallurgical coke making. In the Coosa coal field of Alabama, an investigation revealed recoverable coal reserves estimated at 11,000,000 tons. Diamond drilling also was done in Colorado, Maryland, and North Carolina. Abroad, Chilean coals and mining conditions were studied at the request of the Chilean Government, and Greek lignite mines were investigated to help the Economic Cooperation Administration make recommendations for improving mining conditions and increasing output.

Coal preparation.—Progress was made in upgrading coking coals through coal-preparation methods, with an intensive study of the Pittsburgh bed in southwestern Pennsylvania and northern West Virginia. Washability and screening tests on various Illinois coal beds demonstrated that two more beds could yield clean coal suitable for metallurgical use. As a result of Bureau research, several commercial preparation plants installed the cyclone thickener to clarify water and recover marketable coal previously discharged as refuse. The Bureau also assisted the Brazilian Government in preparing coal in the Santa Catarina field, resulting in increased production of metallurgical fuel for steel, and studied the performance of an Alaska washing plant handling considerable refuse material.

Coking, gasification, and drying studies.—In tests, the Bureau found that West Virginia coals not extensively used for coking were suitable for making metallurgical coke if used in appropriate blends. A low-volatile coal was blended with 12 high-volatile coals, and the properties of the resulting coke were studied. Continued research on the complete gasification of partly carbonized coking coals in the Lurgi pressure generator resulted in improved operation and increased gas production.

Pilot-plant tests were made on the high-speed drying of lignite and subbituminous coals to demonstrate the technical success of the process and provide information for the design of larger, commercial-scale plants. To help the Economic Cooperation Administration develop Greek natural resources, Greek lignites were dried. Design improvements in Bureau lignite-gasification pilot plants also were tested.

Coal combustion.—To aid householders and industries in selecting fuel-burning equipment, the Bureau determined the performance and efficiency of burning various coals on domestic stokers and compared hand and oil firing. In power-station boilers, improvements were made in instruments and methods of measuring heat flow in big, pulverized-coal-fired furnaces.

Research facilities.—At Schuylkill Haven, Pa., construction of the Anthracite Research Laboratory was begun in November 1948. At Grand Forks, N. Dak., plans for design of the Lignite Research Laboratory were completed, bids for construction were received, and building contracts were awarded.

Services to Government.—Over 24,000 samples of coal and related materials from coal research were analyzed by the Bureau, including samples from Government coal purchases and coal-mine dusts submitted by Federal inspectors. The Bureau made boiler-plant operating-cost comparisons for the use of oil, gas, and coal and recommended suitable-type fuel-burning equipment for 37 projects of the Veterans' Administration and 6 of the Army Department. Boiler-plant surveys were made for various Federal agencies, resulting in annual operating savings of $1,600 to $54,000 a plant. The Bureau helped 34 Government agencies solve 125 special fuel problems, conducted schools for coal samplers for the Army Air Force in New York, Ohio, Georgia, and Utah, and sampled 500,000 tons of coal for shipment to Japan.

In serving Federal boiler plants, the Bureau analyzed over 8,700 samples of boiler water and made recommendations. Research in the corrosion of boiler-room equipment continued, and a new, less costly chemical for preventing corrosion was discovered. Under Presidential directive, the Bureau passed on more than 425 pieces of oil- and gas-burning equipment for Federal agencies. Twenty different cities also received smoke-abatement advisory services.

Gas- and dust-explosion research.—To reduce the damage of coal-mine explosions, the Bureau studied an effective way of dispersing rock dust from bags underground in front of an on-coming coal-dust explosion. This method stops the explosion and extinguishes it. In place of inefficient hand methods, the Bureau also developed a rapid way of applying rock dust on mine floors through the use of permissible explosives.

A theory of the ignition of firedamp and the stabilization and quenching of firedamp flames was developed, research on methods and materials for putting out coal mine fires was continued, investigations to detect explosion hazards of static electricity in operating rooms were made in Pittsburgh hospitals following a series of fatal anesthetic explosions, and a method of predicting burner performance when mixing gas fuels was developed for the gas industry.

To assure greater safety in manufacturing and using hazardous chemicals in industry, the Bureau demonstrated that gaseous explosions at high pressures could be extinguished by adding inert gases and by controlling the oxygen content. Inflammability limits and ignition temperatures for numerous combustible gases and vapors of industrial importance also were determined. Testing of 72 samples of various kinds of dusts increased the total number examined to about 1,375 and provided more information for use in preparing national and State safety codes.

SYNTHETIC LIQUID FUELS

Continuing a vast synthetic liquid fuels research program, the Bureau made tremendous strides in reducing the cost of producing motor and aviation gasoline from coal, and of mining oil shale, long a deterrent to oil-shale development.

Oil from coal.—At Louisiana, Mo., two new coal-to-oil demonstration plants—first of their kind in this country and incorporating numerous innovations as forerunners of a new basic industry that ultimately may free the United States from dependence on foreign oil—were dedicated on the fourth anniversary of VE-day, May 8, 1949.

The coal-hydrogenation plant, a 200- to 300-barrel-a-day unit, employs pressures up to 10,300 pounds per square inch in two major operations: Liquid-phase hydrogenation, which liquefies the coal; and vapor-phase hydrogenation, which converts the liquefied coal to gasoline and byproducts. The gas-synthesis plant, an 80- to 100-barrel-a-day unit, will gasify pulverized coal with oxygen and superheated steam and then convert the resulting synthesis gas—a mixture of carbon monoxide and hydrogen—to liquid fuels. Remaining units of this plant will be completed in 1950. Trial runs in the coal gasifier yielded an acceptable synthesis gas. Both plants were operated to a limited extent before the dedication.

Based on commercial-size operations, the most significant cost estimates disclosed that a 30,000-barrel-a-day hydrogenation plant using Illinois bituminous coal as raw material could produce motor gasoline for 10.2 cents a gallon and aviation gasoline for 15 cents a gallon.

At Bruceton, Pa., in the Bureau's coal-to-oil laboratories and pilot plants, fundamental process improvements were under development. With synthesis gas the most expensive cost item in the Fischer-Tropsch process, significant progress was made in developing two promising methods for more efficient conversion—the internally cooled, fixed-catalyst-bed method and the oil-catalyst, slurry method.

To cut major costs, the Bureau studied the rapid conversion of coal to distillable oil, gas, and coke at moderate pressures and relatively high temperatures. Two pilot plants for coal hydrogenation were placed in operation during the year—one for the liquid-phase and the other for the vapor-phase operation.

At Morgantown, W. Va., where processes for the low-cost production of synthesis gas were under development, a pneumatic feeder was perfected that increases by some 30 times the quantity of pulverized coal that may be conveyed to a gas generator by 1 cubic foot of air. A new coal-gasification pilot plant achieved efficiencies of better than 85 percent in the initial runs. Improvements in a laboratory-scale unit made it possible to gasify continuously the most strongly coking coals, as well as the cheapest low-grade coal with high ash and sulfur content.

At Gorgas, Ala., the Bureau touched off its second experiment in underground gasification of coal in cooperation with the Alabama Power Co.

Oil from shales.—At Rifle, Colo., progress was made in mining shale, retorting it to produce oil, and refining crude shale oil into useful products. Mining costs, long a major hindrance to oil-shale development, were largely solved in the Bureau's experimental mine on the naval oil-shale reserves near Rifle. Low-cost volume production was achieved through complete mechanization. In a test run, more than 29,000 tons of oil shale were mined at a direct cost of 32.9 cents a ton, and the average production for each underground worker per shift was increased to 111 tons. The average output for all labor was 92.7 tons a shift for each man, as compared to an average of 5.4 tons a man in coal mines. Unique practices and equipment used in the experimental mine were demonstrated to industry. These included a four-drill jumbo, which breaks 1,500 tons of stone, special equipment used in charging explosives into blast holes, and other drilling equipment for sinking vertical holes.

Two new installations were completed and placed in operation at the oil-shale demonstration plant at Rifle, Colo.: A continuous pilot-plant retort for extracting oil from shale, known as the gas-flow retort; and an experimental refinery, the first continuous unit in this country for treating crude shale oil to obtain finished products—gasoline, Diesel fuel, heating oils and fuel gas.

At Laramie, Wyo., research and development studies established further basic essential information on the processing of oil shale and shale oil, while experimental retorting yielded encouraging results. Laboratories turned to chemical treating to improve product quality. Low-pressure hydrogenation showed promise as a method for processing shale oils. Numerous analyses and determinations were made upon oil shales from the Bureau's experimental mine and from foreign countries. A procedure was developed for separating nitrogen compounds from shale-oil distillates, and methods for determining nitrogen in shale-oil materials were modified to obtain more accurate values.

PETROLEUM AND NATURAL GAS

With petroleum consumption at peak levels, the Bureau stepped up research to increase petroleum resources and the efficiency of using the products derived from them.

A petroleum-engineering study of the New Hope field, Franklin County, Tex., was completed—first Bureau study in which pressure maintenance was applied by water injection to oil-bearing reservoirs before depletion. The Bureau investigated the North Lindsay field, Okla., and outlined the best production practice to obtain maximum recovery of oil. New studies were begun on the Dove Creek field in Colorado, and engineering information which gives promise of recovering many more million barrels of oil was obtained from laboratory research and study of the reservoir fluids from the Rangely field, Colo. To determine the water and petroleum content of oil-bearing rocks, studies were made on drill cores from wells in the Mercy, Tex., Rangely, Colo., and South Coles Levees, Calif., fields, and from wells in the Gulf Coast and Appalachian areas.

Of 40 materials tested, the Bureau found that industrial wastes from domestic lumber and wine industries were the most promising substitutes for quebracho, imported for use in controlling the viscosity of drilling muds in oil wells. To minimize corrosion of equipment in high-pressure gas-condensate wells, the protective value of certain chemical compounds was established in field tests, while laboratory experiments determined the comparative resistance of 32 steels to corrosion. Improvements in techniques of measuring subsurface pressures also resulted in greater accuracy in measuring the productivity of high-pressure oil and gas wells.

To recover oil now left behind in reservoir rocks, the Bureau studied forces acting at the rock-water, rock-oil, water-oil, water-gas, and oil-gas interfaces in petroleum reservoirs. New petroleum-engineering studies got under way in Texas, Oklahoma, West Virginia, Pennsylvania, and Arkansas. In California, the Bureau studied the operations of 23 gas-injection projects in 19 fields and 3 water-flooding operations. Other secondary recovery work included research in the channeling of injected fluids introduced into a formation to displace oil, studies to determine if more oil can be obtained from sand by tunneling into the sand and applying heat at the exposed sand face, research to develop a hot-water separation process for recovering hydrocarbons from bituminous sandstone in California and Utah, and an investigation of oil- and gas-well shooting.

In chemistry and refining, the Bureau continued to study the composition of Diesel fuels and their combustion characteristics, uncovering information that may have an important bearing on the ignition characteristics of hydrocarbons and their mixtures that go to make up Diesel fuels. Techniques for separating and determining organic sulfur compounds in petroleum were devised and are now being applied to seven high-sulfur domestic crude oils. The Bureau also accelerated its program on the synthesis and purification of sulfur compounds, analyzed 115 crude oils, including 10 from important foreign fields, studied the suitability of Rocky Mountain crude oils for making asphalts, and completed a 3-year study of the availability of fuels for military aircraft.

Last year, the Bureau again made studies to determine accurate values for the thermodynamic properties of hydrocarbons and related substances, began a program to determine the thermodynamic properties of organic sulfur compounds, and studied the thermodynamic properties of hydrazine, a potential rocket propellant of special interest to the armed services.

HELIUM

At the Bureau's Exell, Tex., Helium Plant, 54,062,443 cubic feet of helium were produced. Of this amount 29 percent, or 15,797,968 cubic feet, was sold for commercial and medical use—about the same volume as sold in the previous year. Helium demand from Federal agencies increased 1½ million cubic feet over 1948.

Last year, the Bureau increased to 99.9 percent the purity of helium needed for use in helium-shielded arc welding. Research also progressed in the use of helium for shielded-arc welding of aluminum, magnesium, stainless steel, and other alloys. Three tracer projects, using helium to determine characteristics of oil and gas reservoirs, were completed for industry, and the search for fields suitable for the production and conservation of helium continued.

EXPLOSIVES TESTING AND RESEARCH

To reduce explosives hazards, the Bureau conducted 1,791 tests on permissible explosives, special and new explosives, detonators, and hazardous chemicals. The list of active permissible explosives was increased to 197 by adding 6 new products. Through education and demonstrations, the Bureau noted that the use of black powder in coal mining had been reduced to 16 percent of all explosives used underground—lowest on record.

Bureau research revealed that the formation of a pocket or trapped mass of fire damp by hot gaseous products from an explosive was one of the most important causes of ignition. The time required to analyze commercial explosives was cut from days to hours through a new method of analysis.

Further investigation of the explosibility of ammonium nitrate, cause of the Texas City, Tex., disaster, disclosed that by adding 25 percent of ground limestone to ammonium nitrate fertilizer, the mixture is relatively safe from explosion by heating.

SAFETY AND HEALTH ACTIVITIES

A gratifying reduction in the American coal-mine-fatality rate in 1948 and the first 6 months of 1949, together with definite evidences of progress in conserving human life and preventing accidents in many segments of the mineral industries, again attested to the soundness of the Bureau's threefold approach to this problem developed over the past four decades.

As the only agency of the Federal Government charged with the responsibility of promoting health and safety in the mining and allied industries, the Bureau continued its work in the following fields:

(*a*) Research and investigation, to determine the hazards and learn the most effective ways of countering them.

(*b*) Education and training of workers and officials, to impart the knowledge and skills thus gained to all throughout the industries.

(*c*) Inspections, to learn what hazards exist in individual coal mines and provide a factual basis for corrective recommendations.

Fewer American miners lost their lives in 1948 in proportion to the tons of coal produced than in any previous year since records were begun in 1910, according to Bureau statistics. The fatality rate for all coal mines—anthracite and bituminous—was 1.56 per million tons. This compares with a rate of 1.69 in 1947, and the previous low of 1.64

in 1946. This is a continuance of the downward trend in coal-mine-fatality rates which began shortly after the Federal Coal Mine Inspection Act was passed in 1941. The fatality rate in 1942 was 2.30 deaths per million tons of coal produced, and it has dropped each year to the low of 1.56 for 1948.

The first 6 months of 1949 also saw an encouraging decrease in the fatality rate. Based on preliminary estimates, fatal accidents during this period were 32 percent lower than in the same period in 1948, and the fatality rate was placed at 1.21 deaths per million tons of coal. No major disasters—in which more than five men are killed—had occurred in January–June 1949.

Investigations, tests, and many types of research constitute the starting point in the Bureau's health and safety activities. An outstanding example is provided by last year's research and investigations on the problem of controlling mine roof. Studies of suspension supports, which utilize expansion bolts in place of conventional timber posts and cross bars, progressed to the point where experimental installations were made in a number of coal and ore mines. There it was found that not only did the new method reduce the risk of accident under some extremely adverse conditions, but it also increased output per man-day by eliminating one step in the timbering cycle and giving the cutting and loading machines a clean sweep.

Other research and investigative projects, conducted primarily to increase mine and plant safety or to reduce health hazards, but almost without exception pointing the way to increased efficiency as well, covered a broad range. Among them were studies of the underground water pools in the Pennsylvania anthracite region, aimed at removing a hazard which not only menaces the lives of many miners, but threatens the continued existence of one of the Nation's oldest industries. Other tests were aimed at developing emergency mine-communications systems for use in rescue operations, while still other studies dealt with carbon monoxide formation and explosions in compressed-air systems, and with the suitability of various mineral materials for rock-dusting coal mines and for use instead of sand to provide traction for mine locomotives. Studies also were conducted on the effect of exposure to dust upon the health of mine haulagemen and tunnel workers.

In the educational and training phase of the Bureau's work, first-aid and mine rescue courses continued to be emphasized. Experience over the years has shown these types of instructions to be effective in preventing accidents by instilling habits of caution in those who have had them, as well as in mitigating the severity of injuries by teaching men what to do and, perhaps even more important, what not to do when they occur. The number of men completing the Bureau's accident-prevention course for mine-safety committeemen, instituted a few years ago to enable members of the groups set up under the contract between most of the Nation's coal-mine operators and the United Mine Workers to perform their duties intelligently, increased markedly during the year. Several thousand coal-mine supervisory officials completed a broader accident-prevention course that the Bureau had tailored to their needs. Other training courses conducted by Bureau personnel during the year dealt with accident prevention in metal mines, and in petroleum and natural-gas fields and plants.

Besides conducting safety and accident-prevention courses, Bureau personnel assisted in preparing problems for first-aid and mine rescue contests, and served as judges. Such contests, which the Bureau is glad to encourage, find the participants not only keenly enthusiastic but so evenly matched that the program often has to be extended to permit the breaking of a tie. In addition, the Bureau maintained close contact with the national Joseph A. Holmes Safety Association, named in honor of its first director, and with the local Holmes Safety Association chapters.

Inspections of bituminous and anthracite mines, designed as a "follow-up" to determine if the results of research and safety training are paying off in the mines, are made by the Bureau of Mines under authority of the Federal Coal Mine Inspection Act of 1941. The Bureau has no regulatory powers whatsoever, and its work is entirely investigative and recommendatory, with emphasis on making full technical information available to operators and workers, and cooperating in correcting hazards underground and on the surface.

In the fiscal year the Federal inspection work, newest of the channels through which the Bureau works to foster safety in the industry, completed its seventh full year. More than 6,500 coal-mine inspections were made, and detailed reports describing conditions and practices prepared and transmitted to operators, workers' organizations, State mining officials, and other interested parties.

In addition to the lower fatality rates mentioned earlier here, it is interesting to note also that during the 9 years prior to Federal inspection, the fatality rate was upward in both anthracite- and bituminous-coal mining. In the 7 years that Federal inspectors have been examining coal mines and the Bureau has been publishing their findings and recommendations, the fatality rate has been consistently downward.

Credit for the improved fatality record is shared by the Bureau of Mines, an increased safety consciousness on the part of workers and operators, the cooperation of State mining officials, and other factors. Much progress has been recorded, but there is a great deal yet to be done. The Bureau will continue its broad program of promoting health and safety.

Investigations and tests.—An outstanding contribution to the roof-control problems in mines was the adapting to coal-mine use of the "suspension roof supports" method which eliminates the need for conventional supports such as posts, timber sets, etc. By this method, overlying strata are bound together with steel rods secured in the roof rock as soon as the roof is exposed to prevent initial roof sag and subsequent falls. Suspension roof supports were installed in 60 coal and 8 iron-ore mines during the year. Their successful use has prompted many more operators to experiment with the method, which promises substantial economies as well as safety. Continuing studies to determine where roof falls are likely to occur in mines, petrographic studies were made of thin sections of rock samples; while results are still inconclusive, there is promise that the method may be helpful.

To detect and evaluate potentially dangerous atmospheric conditions in mines, the Bureau analyzed approximately 16,000 gas and dust samples, and recommendations based on more than 100,000 individual determinations were made to correct or prevent hazards from exposure to flammable gases or harmful atmospheric contaminants. These samples were collected in coal, metal, oil shale, limestone, barite, clay, and salt mines, in tunnels, in connection with the use of Diesel-powered equipment underground, and in connection with various other laboratory and field investigations. The results were also used in ascertaining progress made in extinguishing sealed mine fires.

X-ray diffraction and petrographic analyses were made to determine the composition of a wide variety of dusts as an aid in evaluating possible hazards to the health of workers, determining the suitability of mineral materials for use in rock-dusting, and use as substitutes for sand as traction material for mine locomotives. Field studies were also made to determine the effects of exposure to silica dust of haulagemen and of men doing rock work in coal mines.

Information on mine and tunnel ventilation, mine air conditioning, and fluid flow was supplied to mine operators and others; studies of heat and moisture changes in air-flow circuits of hot, deep mines was continued; and mine air-conditioning installations were inspected at two metal mines in Western States. Laboratory tests were conducted on the performance characteristics of gas-indicating instruments, the causes of carbon monoxide formation and explosions in compressed-air systems, and the spontaneous heating of carbonaceous slates in some iron-mining operations.

Approval was given to 53 complete units of electrical equipment and to 59 explosion-proof parts as permissible for use in gassy mines; 3,303 explosion tests were made in connection with this work. In addition, 483 samples of cables were tested to determine the flame-resisting properties of 102 trailing cables. Six new approvals and numerous extensions of approval were granted for respiratory protective devices. The significance of this work is indicated by the almost universal acceptance and requirement by industries, insurance companies, and Government agencies of Bureau of Mines approved devices.

Emergency mine-communications apparatus for use in rescue operations were further tested to determine whether voice communication through soil and rock by radio is practicable. These tests were made in the deep metal mines of western United States. In cooperation with the Navy Department, Bureau of Ships, tests were made to determine the nature and quantity of toxic gases liberated in the burning or thermal decomposition of synthetic resins that might be used in electrical insulation. Other investigations for the Navy included tests for fire hazards connected with aircraft fuel gages and the acceptability of explosion-proof electric equipment used on naval vessels.

The Bureau also completed an investigation of the underground water pools in the Pennsylvania anthracite regions, essential in solving the mine-water problem threatening the life of the anthracite industry. The survey revealed that 91 billion gallons of water are impounded in 159 pools in underground workings and 2.3 billion gallons in abandoned stripping operations. Other investigations in connection with this mine-water situation included studies of the "buried valley" of the Susquehanna River, where a large tonnage of anthracite lies beneath the ancient channel now filled with water-bearing deposits, existing pumping facilities and drainage tunnels, deep well-pumps, and possible sites for drainage in the Northern and Southern fields of the anthracite area.

If the large anthracite reserves beneath this "buried valley" are to be recovered, it is of prime importance to present and future mining operations to know the configuration, extent, and nature of the water-bearing deposits and the relative position of the underground workings to prevent the mine workings breaking into the valley-fill deposits unexpectedly, with resultant loss of life and property. To date information has been compiled on 13,000 bore holes, and from this and other information 57 contour maps have been prepared.

Safety education.—Since inauguration of the accident-prevention course for coal-mine officials in January 1948, 3,376 have completed the training, which was conducted by 22 mining engineers assigned to such work. The accident-prevention course for mine-safety committeemen and other mine workers was established in January 1947, and since then, 10,968 have completed the training. The subjects included falls of roof and coal, handling and storage of blasting materials, use of electricity, ventilation, haulage, explosions and fires, and other hazards.

During the fiscal year, 32,305 employees of the mining and affiliated industries were trained in first aid and mine rescue, bringing the total number of persons who have completed such courses since the establishment of the Bureau in 1910 to 1,737,794. With the training of 297 instructors, more than 18,000 persons throughout the country have become qualified to teach the Bureau of Mines first-aid courses. During the year, 87 more mines and plants were awarded certificates showing that their entire personnel had been trained in first aid.

Metal-mine accident-prevention training was given during the year to 1,019 persons who completed the course and to 213 who received partial training. Also during the year, 17 persons received training in the use of explosives, while 296 completed and 288 received partial training in the petroleum-gas safety course.

The Bureau continued to maintain contact with local chapters and district councils of the Joseph A. Holmes Safety Association. The association gave safety awards to numerous plants, supervisors, and individuals in all branches of the minerals industries, presenting them at meetings where Bureau of Mines personnel participated.

Coal-mine inspections.—During the year, exactly 6,674 Federal inspections of bituminous and anthracite mines were completed, bringing the total number of inspections since the inception of the program to 25,000. These inspections have covered 5,898 coal mines in the United States and Alaska, leaving about 4,000 small mines yet to be inspected.

With the addition of several new Federal inspectors in the 1949 fiscal year, the staff was increased to 250 men. Most of these are engaged in regular inspections, but some are constantly on duty as teachers of various accident-prevention and safety courses and as consultants on special mine problems that arise from time to time.

The Federal Mine Safety Code for Bituminous and Lignite Mines of the United States is the criterion used by Federal inspectors in examining bituminous mines. For anthracite mines, the inspectors follow the Federal Safety Standards for Anthracite Mines.

Federal inspections have revealed many hazards that had been overlooked or ignored previously, and the widespread publicity given the results has stimulated interest in coal-mine safety. In a sense, the publicity is another facet of the Bureau's educational efforts. The contracts between the majority of the coal-mine operators and the United Mine Workers of America have provided for compliance with Federal inspectors' recommendations for correcting hazardous conditions and practices while making routine inspections. These contracts also provide for recognition of mine-safety committees composed of

United Mine Workers personnel, the members of which are authorized to inspect any mine development or equipment used in producing coal, and to report their findings and recommendations to the management.

Such influences have brought about a more rapid improvement in accident rates during the 7 years of Federal inspections, and it is likely that they will continue to have a favorable influence. Additional impetus is necessary to maintain and possibly increase the current interest in mine safety, and the Bureau of Mines intends to carry forward its work with even greater zeal.

ECONOMICS OF THE MINERAL INDUSTRIES

Heavy demands for economic and statistical data needed by industry and Government in planning vital national security programs, together with an increasing public interest in promoting safety in the mineral industries, underscored the importance of the Bureau's statistical services during the past year. Ranking high on the list of special services rendered by the Bureau were studies basic to the determination of stock-pile objectives, current stock-pile procurement schedules, conservation legislation, mobilization planning, and ECA procurement policies.

In addition to providing the Munitions Board and the National Securities Resources Board with information on domestic and foreign economics of metals, the Bureau also supplied the Economic Cooperation Administration with actual and potential metal production and consumption rates and surveyed metal-production capacities for the Council of Economic Advisors. Internationally, Bureau representatives participated in the third and fourth meetings of the International Tin Study Group convened at The Hague. At home, Bureau specialists served on numerous departmental committees.

Although the Bureau's statistical research programs were shaped largely by special and urgent requests of industry and Government, most of the normal statistical services were maintained. These included canvasses of commercially important mineral commodities, preparation of information circulars, issuance of Mineral Trade Notes (a monthly compilation of foreign mineral-commodity information), reviews of developments in the nonmetallic mineral industries, studies of petroleum, natural gas, and oil shale, along with statistical surveys of the coal, coke, and coke byproducts industries, and compilation of accident data. However, since the Bureau's facilities were inadequate to meet all demands, some essential routine services, including publication of the authoritative Minerals Yearbook, were curtailed or delayed.

Metals.—To help provide Government and industry with the latest economic and statistical information on conditions and developments in the metal industries at home and abroad, the Bureau published more than 280 annual, quarterly, and monthly reports. Assisting the renewed drive to conserve America's mineral resources and strengthen the national defense, the Bureau prepared special reports on a variety of subjects, including data for determining strategic stock-pile objectives and geographic localization of strategic metal consumption as a basis for locating storage depots. Numerous services were rendered upon request to members of Congress and congressional committees, and Bureau metals specialists served on committees of the Munitions Board and were consulted by the National Security Resources Board. Facilities for collecting basic data in the field were extended with establishment of a branch office at Juneau, Alaska.

Nonmetallics.—Statistical canvasses of all of the commercially important nonmetallic minerals, including building materials, chemical raw materials, mineral fertilizers, abrasives, and ceramic raw materials, were conducted; and annual reports, supplemented in some instances by monthly, quarterly, and semiannual reports, were published. A book on the commercial utilization of blast-furnace slag, a cooperative project of the Bureau and a trade association, was released, and the Bureau also completed several chapters for a volume titled "Industrial Minerals and Rocks," which will be issued by the American Institute of Mining and Metallurgical Engineers. The Graphite, Mica, Phosphate Rock, Potash, and Sulfur chapters for a cooperative geographic publication of the Bureau and the University of Maryland were completed, and two general reviews of developments in the nonmetallics minerals industries were prepared by the Bureau and published in trade journals.

Petroleum.—As oil is becoming an increasingly important factor in national defense and industrial planning, requests for information on this vital commodity were unusually heavy. To help expand its statistical coverage, the Bureau initiated a series of analytical studies of the petroleum, natural-gas, and shale-oil industries of certain foreign countries under a cooperative agreement with other Government agencies. As a further service to industry and Government, efforts were made to obtain periodic operating statistics and other information relating to petroleum in foreign countries and to permit publication of a monthly supply-and-demand balance for the world, by principal countries. Monthly petroleum statistics covering the domestic industry were expanded to increase the usefulness of the information; and the annual survey covering fuel consumption at petroleum refineries, suspended during the war period, was resumed and the statistics for 1942–47 released. Because of growing interest in foreign oil operations, tables were added to the Petroleum chapter of the 1947 Minerals Yearbook to show exports and imports by source and destination in greater detail.

Coal.—A declining rate of coal production and changes in the stock and consumption position of major classes of consumers stimulated many requests for information. In response to these demands, the Bureau made numerous and varied statistical and economic studies, and reports on production, distribution, consumers' stocks, consumption, and use of bituminous coal, anthracite, lignite, and coal chemicals. Data were kept up to date, and continuing analyses were made regarding changes in coal production and the impact of changing conditions on the national economy.

With full industry support, the Bureau continued its comprehensive statistical surveys to provide statistical and economic data pertaining to the anthracite, coke, and byproducts industries, including special analyses regarding productive capacity in the coke industry. During the early part of the year, members of the staff served as advisers to both the United States Commerce Department and members of industry in connection with the establishment of steel allocations for the mining-machinery and anthracite industries. Bureau representatives, both as members and in preparing basic data, took an active part in the work of a number of important committees concerned with peacetime and emergency availability of coal. The Bureau also cooperated closely with committees and members of the National Bituminous Coal Advisory Council in preparing reports pertaining to the bituminous-coal industry which were of special interest to Government and industry.

Foreign minerals.—With growing dependence of American industry on foreign sources of supply and increasing participation of the United States in world affairs, the services rendered by the Foreign Minerals Section assumed added importance.

The scientific and technical cooperative program conducted by the Bureau under Public Law 402 was extended during the year to Afghanistan, the first country in the Eastern Hemisphere to receive such assistance since the passage of the law in January 1948. Siam and India have officially requested assistance under the act, and a study is now under way to determine the most effective type of technical aid that the Bureau can render to these two countries.

During the year, a Bureau metallurgist was assigned to Brazil to serve as technical adviser to its National Department of Mineral Production. The Mexican program is now firmly established, and accomplishments during the year clearly indicate that this project may become a model for work in other countries. After 3 months' study in Argentina by a coal-processing specialist of the Bureau, a program has been approved for the next fiscal year. Similarly recommended projects have been approved in Peru and Venezuela and will soon become part of the Bureau's program under Public Law 402.

Accident and employment data.—Promotion of the safety of workers in America's mines and industrial plants continued to be a major industrial and governmental objective. As a result, the Bureau's injury statistics on the mineral industries became correspondingly important as an effective yardstick of the progress of safety work in the mines. The new monthly series of reports on coal-mine injuries filled an important gap in current information on safety. Following initiation of the benefit payments to coal miners under the industry's welfare fund, more detailed tabulations and analyses of coal-mine-injury records have been demanded by industry and labor groups. In addition to regular compilations, many special tabulations were supplied to congressional committees, Government agencies, employee unions, operator groups, and others interested in mine safety. In the safety competitions conducted by the Bureau, enrollment in 1949 reached a record total of 808 mines and quarries, while in the 1948 competitions, the Bureau awarded 1,145 certificates of achievement to men and companies for outstanding safety work.

PUBLIC REPORTS

The volume of publications prepared and issued by the Bureau increased over the previous year as a result of continuing demands from industry, Government agencies, and the public for information on all phases of the minerals industries. In addition many technical papers and reports that were withheld during the war were released for publication.

To fulfill its responsibility for keeping the minerals industry and the public informed of trends and developments, the Bureau disseminated its technologic, scientific, and economic information among those to whom it would be of value. At the same time, the number of copies of each publication was held to a minimum to conserve funds.

Results of the Bureau's investigations were distributed in the form of printed and processed reports, in speeches before scientific and trade organizations, and in articles published in technical and trade periodicals. In summary, 753 manuscripts were edited during the year, compared with 690 last year. These included 8 bulletins, 16 technical papers, 83 chapters of Minerals Yearbooks, and 16 miscellaneous publications—a total of 123 printed reports. In addition, there were 237 reports of investigations, 49 information circulars, and 16 mineral trade notes—a total of 292 processed reports. A total of 338 speeches and articles were prepared for technical societies and the trade press. Galley and page proofs were read and indexes prepared for the printed material. The cumulative list of all printed and processed publications issued by the Bureau since its creation in 1910 was completed and indexed. Many special services were rendered the Department in the course of the year, including indexing the Correspondence and Style Handbook and indexing the Senate hearings on the Interior appropriation bill.

During the year, 3,723 books and pamphlets were added to the Bureau's Washington reference library, bringing the number of items to 76,042. As the year ended, 484 periodicals were being received and recorded, and 245 of them were circulated to Bureau staff members as soon as received. For use outside the library 28,872 books and periodicals were lent or routed. A total of 3,687 readers used the library, and there were 4,571 telephone inquiries. Exactly 6,852 cards were added to the card catalog.

Another all-time record was established in the number of showings of films from the Bureau's free loan library of educational motion pictures during the year. Bureau films were exhibited 151,897 times, up 14 percent over the previous year, and an increase of 18,867 over the former high of 133,030 showings reached in fiscal year 1948. The attendance at these showings totaled 10,515,423, plus an estimated attendance of 6,938,000 at television showings, which had increased considerably during the year. This brings the total attendance to 17,453,423, which exceeds last year's record by 4 percent.

A total of 1,070 new copies of films were added to the library, and 705 copies were withdrawn because of obsolescence and ordinary wear. At the end of the year, the library had 6,247 copies of films, totaling 13,985 reels, in circulation. This was a net increase of 6 percent in copies of films and 4 percent in the number of reels.

Eight new films became available for distribution during the year. They were The Story of Gasoline; Arizona and Its Natural Resources; Wyoming and Its Natural Resources; Nevada and Its National Resources; The Story of Tinplate; The Story of Lubricating Oil; Zinc—Its Mining, Milling, and Smelting; and The Story of a Spark Plug. The last-named film was a revision of an earlier picture.

These and other Bureau of Mines educational films are in 16-millimeter width, all in sound except a few of the earlier ones, and many in full color, including most of the films added in 1949 fiscal year. Like all films in the Bureau's loan library, the 1949 films were sponsored by industrial concerns, which defrayed the costs incidental to production and provided the Bureau with enough copies for distribution to schools, colleges, training classes, the armed services, business and civic groups, and other recognized organizations. No charge is made for the loan of the films, but the borrower pays transportation costs and for any film damage other than normal depreciation.

ADMINISTRATION SUMMARY

The decentralization to the field service of the functions of purchasing, disbursing, and property accounting was continued during the fiscal year. The purpose of this particular type of decentralization is to speed up the delivery of material and supplies to the point of use as well as to expedite the payment of vendors' bills and invoices. This was accomplished by certain changes in the organization of existing administrative units and the setting up of one new unit. The ultimate goal is to decentralize all of the administrative work now conducted from Washington, D. C., so that the responsibility for accounting and personnel functions as well as purchasing and disbursing will be placed in regional offices in the field.

This work of decentralization will proceed as rapidly as possible during the fiscal year 1950. The first step will be the delegation of personnel authority to the principal field stations so that they will have authority to make appointments and status changes in positions which have been allocated and established as well as to fill vacancies vice such positions and to take additional identical actions on such positions. This authority will be delegated to the field for all positions in CAF–1 through CAF–7; P–1 through P–2; CPC–1 through CPC–10; SP–1 through SP–8; and all ungraded jobs.

Reorganization plans are proceeding for the establishment of eight regional offices in the United States and Alaska.

The Office of the Bureau Safety Engineer is charged with the formulation and direction of a program to improve the health and injury experience of employees of the Bureau of Mines. With direct responsibility to their immediate supervisors, there are now four safety engineers in two of the three plants of the Office of Synthetic Liquid Fuels with a vacancy in the third plant which is being filled.

Of the 67 stations or groups of the Bureau of Mines exceeding 10 employees in number, 25 groups had no disabling injuries in the calendar year 1948. Many of the remaining groups had only a single disabling injury. Steps are being taken to improve the experience of those groups which continue to contribute a sufficient number of disabling injuries annually to hold down the statistical improvements of the Bureau as a whole.

The severity rate of the Bureau of Mines with the exception of that for the calendar year 1948, when 3 fatalities were suffered, has been extremely low. While it is desirable to reduce the number of lost-time injuries, many authorities in safety work believe that low severity rates, which are the number of days lost time per thousand man-hours of employment, are much more important than the number of disabling injuries without considering the seriousness of them. If that is to be taken as a criterion the Bureau of Mines has achieved a very important goal.

PERSONNEL

On June 30, 1949, there were 3,970 full-time employees in the Bureau of Mines, distributed as follows:

TABLE 1.—*Classification and number of appointees*

	P&S	SP [1]	CAF	CPC [2]	Total
Departmental	75	3	408	16	502
Field	1,036	634	927	771	3,368
Total	1,111	637	1,335	787	3,970

[1] Includes instrument makers, safety instructors, laboratory aids, assistants, etc.
[2] Includes laborers, mechanics, messengers, wage employees, etc.

FINANCE

The total funds available to the Bureau of Mines for the fiscal year ended June 30, 1949, including direct appropriations, departmental allotments, reappropriated balances, and sums transferred from other departments for service work, were $30,759,657. Of this amount, $28,292,269 was expended, leaving an unexpended balance of $2,467,388. On the regular work of the Bureau, $25,996,102 was expended. These figures are subject to revision because of unpaid obligations.

Table 2 presents classified information regarding the financial history of the Bureau for the fiscal years ended June 30, 1946–50.

TABLE 2.—*Bureau of Mines appropriations and expenditures, fiscal years ended June 30, 1946–50*

Fiscal year	Appropriated to Bureau of Mines	Departmental allotments [1]	Funds transferred from other departments [2]	Total funds available for expenditures	Unexpended balances	Total expenditures	Expenditures, exclusive of service item [3]
1946	$17,846,838.69	$6,500	$2,384,271	[4] $25,301,457.69	[5] $8,050,809.69	$17,250,648	$16,009,760
1947	16,000,515.00	7,800	1,641,243	[5] 26,052,579.00	[6] 10,114,009.00	15,938,570	14,885,652
1948	18,741,181.00	6,500	3,068,284	[6] 21,788,965.00	[7] 1,623,519.00	20,165,446	18,769,286
1949	27,020,990.00	6,000	3,732,667	[7] 30,759,657.00	[8] 2,467,388.00	28,292,269	25,996,102
1950	25,065,800.00	6,000	1,853,170	[8] 26,924,970.00	---	---	---

[1] Includes stationery and contingent funds.
[2] Includes proceeds from sales of residue gas.
[3] Service items include helium and other investigations and services for other departments.
[4] Includes $4,678,164 unexpended balance reappropriated, and balance of $385,684 receipts from sale of helium and other products.
[5] Includes $3,176,386 unexpended balance reappropriated, and balance of $457,684 receipts from sale of helium and other products.
[6] Includes $6,501,988 unexpended balance reappropriated, and balance of $800,727 receipts from sale of helium and other products.
[7] Includes $81,471 unexpended balance reappropriated, and balance of $720,155 receipts from sale of helium and other products.
[8] Includes $913,300 unexpended balance reappropriated, and balance of $672,322 receipts from sale of helium and other products.

Table 3 gives a statement of the distribution of congressional appropriations to the divisions and branches, and the expenditure of these funds in 1949 by Bureau divisions.

TABLE 3.—*Bureau of Mines expenditures, fiscal year 1949*

Division or branch	Salaries and expenses	Operating rescue cars and stations and investigation of accidents	Control of fires in inactive coal deposits	Coal-mine inspections and investigations	Testing fuel	Anthracite-mining investigations	Construction and equipment of anthracite research laboratory	Construction and equipment of lignite laboratory	Synthetic liquid fuels	Production and sale of excess power synthetic liquid fuels	Mineral mining investigations
Office of the Director	$28, 145	$606				$5			$131		
Office of Minerals Reports	2, 596	33, 751		$110, 088	$7, 892			$1, 352	105, 810		
Total	30, 741	34, 357		110, 088	7, 892	5		1, 352	105, 941		
Administrative Division	93, 230	75, 326	$15, 290	48, 574	31, 950	13, 762			467, 302		$26, 998
Mining Division											147, 991
Metallurgical Division	50										245, 855
Fuels and Explosives Division:											
Coal Branch		94, 386		102, 415	347, 635	85, 995	$1, 369	42, 738	47, 707		
Explosives Branch		343, 113									
Fuels Utilization Branch	137				134, 736						
Petroleum and Natural Gas Branch	247								2, 534, 326		
Synthetic Liquid Fuels Branch									10, 994, 030		
Total	384	437, 499		102, 415	482, 371	85, 995	1, 369	42, 738	13, 576, 063		
Economics and Statistics Division:											
Coal Economics Branch	1, 733										
Foreign Minerals Branch	212										
Metal Economics Branch	38, 166										
Accident Analysis Branch	2, 229			20, 498							
Nonmetal Economics Branch	1, 277										
Petroleum Economics Branch	1, 120										
Total	44, 737			20, 498							
Health and Safety Division:											
Coal Mines Inspection Branch	37		234, 125	2, 047, 486							
Safety Branch	84	538, 494		11, 425		177, 721					
Health Branch	197	77, 230		85, 602							
Total	318	615, 724	234, 125	2, 144, 513		177, 721					
Total appropriations	169, 750	1, 165, 000	250, 000	2, 431, 500	522, 400	396, 100	1, 369	200, 000	14, 150, 000	$735, 000	421, 300
Total expenditures	169, 460	1, 162, 906	249, 415	2, 426, 088	522, 213	277, 483	1, 369	44, 090	14, 149, 306		420, 844
Balance	290	2, 094	585	5, 412	187	[1] 118, 617		[2] 155, 910	[2] 694	[2] 735, 000	456

Footnotes at end of table.

TABLE 3.—*Bureau of Mines expenditures, fiscal year 1949*—Continued

Division or branch	Investigation and development of domestic mineral deposits	Coal investigations	Oil and gas investigations	Purchase of land, etc., Bartlesville, Okla.	Expenses, mining experiment stations	Metallurgical research and pilot plants	Care, etc., buildings and grounds, Pittsburgh, Pa.	Economics of mineral industries	Reduction of zinc concentrates with methane gas	Drainage tunnel, Leadville, Colo.	Helium utilization and research
Office of the Director			$82		$813			$11, 572			
Office of Minerals Reports	$36, 037	$12, 307			1, 973	$6, 766		6, 180			
Total	36, 037	12, 307	82		2, 786	6, 766		17, 752			
Administrative Division	105, 473	6, 058	32, 429		226, 751	57, 746	$330, 372	55, 648			$4, 441
Mining Division	1, 221, 682				457, 588					−$20, 216	
Metallurgical Division	196, 543				636, 310	1, 394, 754			−$8		
Fuels and Explosives Division:											
Coal Branch		271, 634			90, 233						
Explosives Branch											
Fuels Utilization Branch		9, 543									
Petroleum and Natural Gas Branch			612, 383								91, 199
Synthetic Liquid Fuels Branch											
Total		281, 177	612, 383		90, 233						91, 199
Economics and Statistics Division:											
Coal Economics Branch								165, 776			
Foreign Minerals Branch								62, 155			
Metal Economics Branch								196, 784			
Accident Analysis Branch								93, 291			
Nonmetal Economics Branch								79, 824			
Petroleum Economics Branch								97, 554			
Total								695, 384			
Health and Safety Division:											
Coal Mine Inspection Branch											
Safety Branch											
Health Branch											
Total											
Total appropriations	1, 560, 000	300, 000	645, 000	$398	1, 415, 000	1, 460, 000	330, 400	769, 900	761	1, 112	96, 000
Total expenditures	1, 559, 735	299, 542	644, 894		1, 413, 668	1, 459, 266	330, 372	768, 784	[4] −8	[4] −20, 216	96, 640
Balance	265	458	106	[2] 398	1, 332	734	28	1, 116	769	[2] 21, 328	360

Division or branch	Helium production	Development and operation of helium properties (special fund)	Metallurgical research and pilot plants contributions	Cooperative funds, synthetic liquid fuels program	Payments from proceeds of sales, motor-propelled vehicles, etc.	Cooperation with the American Republics	Missouri River Basin (reimbursable)	Working funds	Contingent expenses	United States dollars advanced from foreign governments, United States information and educational exchange program, Department of State	Total
Office of the Director											$41, 354
Office of Minerals Reports			$327					$1, 121			326, 200
Total			327					1, 121			367, 554
Administrative Division	$20, 612	$12, 634			$640		$7, 275	172, 364	$5, 969		1, 810, 844
Mining Division					15, 815		109, 495	134, 794		$10, 000	2, 077, 149
Metallurgical Division			3, 000		686			393, 366		2, 000	2, 872, 556
Fuels and Explosives Division:											
Coal Branch					1, 006		22, 712	6, 772			1, 114, 602
Explosives Branch								290, 860			633, 973
Fuels Utilization Branch								11, 844			156, 260
Petroleum and Natural Gas Branch	394, 606	424, 140		$22, 805	1, 824		8, 921	144, 968			4, 235, 419
Synthetic Liquid Fuels Branch					760						10, 994, 790
Total	394, 606	424, 140		22, 805	3, 590		31, 633	454, 444			17, 135, 044
Economics and Statistics Division:											
Coal Economics Branch											167, 509
Foreign Minerals Branch						$45, 174		24, 305			131, 846
Metal Economics Branch					142						235, 092
Accident Analysis Branch					378						116, 396
Nonmetal Economics Branch			7, 500								88, 601
Petroleum Economics Branch								5, 852			104, 526
Total			7, 500		520	45, 174		30, 157			843, 970
Health and Safety Division:											
Coal Mine Inspection Branch										4, 000	2, 285, 648
Safety Branch								8, 751			736, 475
Health Branch											163, 029
Total								8, 751		4, 000	3, 185, 152
Total appropriations	[3] 421, 288	[3] 1, 109, 096	13, 730	27, 300	21, 471	50, 500	171, 253	1, 902, 029	6, 000	16, 000	30, 759, 657
Total expenditures	415, 218	436, 774	10, 827	22, 805	21, 251	45, 174	148, 403	1, 194, 997	5, 969	16, 000	28, 292, 269
Balance	6, 070	[2] 672, 322	[2] 2, 903	[2] 4, 495	220	5, 326	[2] 22, 850	[5] 707, 032	31		2, 467, 388

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[1] Includes Budget reserve, $25,000.
[2] Available for expenditure in 1950 fiscal year.
[3] Includes reimbursements to appropriation.
[4] Unliquidated balance of contractual obligations released.
[5] $704,968 of balance available for expenditure in fiscal year 1950.

Property records of the Bureau of Mines, as of June 30, 1949, show accounts as follows:

Automobiles and trucks	$1, 179, 008. 19
Canvas and leather goods	19, 784. 11
Drafting and engineering instruments	76, 478. 71
Electrical equipment	275, 145. 19
Hardware and tools	349, 163. 75
Household equipment	84, 616. 21
Laboratory equipment	4, 721, 504. 07
Medical equipment	38, 442. 19
Office furniture and equipment	1, 324, 209. 84
Photographic apparatus	120, 008. 40
Machinery and power plant equipment	4, 966, 414. 43
Land, buildings, and improvements	27, 801, 198. 85
Rescue cars and specialized apparatus	521, 298. 45
Total	41, 477, 272. 39

This property is in Washington and at the various field stations and offices of the Bureau.

Geological Survey

W. E. Wrather, *Director*

THE Geological Survey is the focal point of many activities concerned with the discovery, evaluation, development, and conservation of the Nation's mineral and water resources. With ever-increasing standards of living inherent in our modern civilization, the metals and minerals for machines, the fuels for power and heat, and the water for power, irrigation, industry, and the home, must be found in ever-increasing amounts. These resources come from the earth, and a thorough knowledge and application of the principles of geology and engineering is required to meet the demands upon our supply of these materials. The hundreds of projects carried on throughout the year on surveys, investigations, mapping, gaging of streams and the measurement of underground waters, coupled with an exhaustive research program designed to achieve new and improved methods and tools for doing the job, have taxed to the limit the available facilities of the Geological Survey.

GEOLOGIC DIVISION

The program of geologic mapping and mineral resource investigations continued during the fiscal year with increasing emphasis on the search for and the evaluation of mineral deposits.

For many years this country was more than self-sufficient in nearly all mineral resources, but the drafts made on our supplies during the last World War have taught us a bitter lesson. Intensive but hurried studies prior to and during the war considerably increased our supplies of some strategic minerals, but in spite of our efforts we became increasingly dependent on imports, largely sea-borne. The discovery of new oil reserves and new mineral deposits have both become increasingly difficult. Probably nearly all the deposits which show valuable mineral at their outcrops have already been discovered. Hope for the future lies (1) in the study of producing districts, in cooperation with operating companies, so as to enlarge known reserves; (2) in the intensive study of districts once productive but now thought to be exhausted, on the chance that geologic study may reveal structures and ore not apparent to the early miners; and (3) the study and geologic mapping of regions where geologic indications are favorable but in which no discoveries have been made. Study of the surface and underground geology is the primary requisite, but these investigations are aided by the examination of plants and soils for trace elements, by geophysical work, and by the use of other specialized techniques.

Recent Survey work, at a cost of $20,000, has revealed thick beds of talc justifying the erection of a $1,000,000 treatment plant, and studies of iron ore have resulted in the discovery of 15,000,000 tons of ore at a cost to the Government of less than a cent a ton.

Long-range projects without immediate economic results must not be neglected, however. The primary function of the Survey is exploration of the unknown parts of this country. Less than 10 percent is covered by adequate geologic maps, and no area can be written off as worthless for mineral production until its geologic structure is thoroughly known. Details of the activities of the Geologic Division are outlined in the reports that follow.

Mineral Deposits

The discovery of new mineral resources is now the responsibility of the scientist. Past discoveries of valuable minerals at the surface of the ground were the starting points of the major mining districts. Now the depths of the earth must be probed for hidden mineral wealth and we must enlist the skill, techniques, and imagination of specialists in many fields of science. In mineral deposits studies the combined efforts of many specialists working in the field and in the laboratory are focused on mineral deposits problems, with special emphasis on areas where the search for new resources offers the most promise. The studies also include ore producing districts where basic geologic studies are needed to serve as a foundation for further exploration by industry. These studies may not produce tangible economic results until several years after the project has been completed, but the knowledge, techniques, and theories which have been developed in one area form the basis for discoveries in other areas. For example, during the past 8 years such studies in New York concerned with the geology of iron deposits have resulted in the discovery of more than 15,000,000 tons of iron ore at a Federal expenditure of $150,000, or less than 1 cent per ton.

Another main objective of mineral deposits studies is aimed at the appraisal of the Nation's known mineral resources in the ground and the chances of finding new deposits. A more precise understanding of our scarcities is needed if our major efforts are to be directed toward the relief of our most vital deficiencies.

During the fiscal year 1949 comprehensive studies of the resource position of the United States with respect to certain strategic minerals was begun. The Survey with other Government agencies is making appraisals of world resources of a number of strategic minerals, at the request of the National Security Resources Board and for the use of the Economic Cooperation Administration.

Other activities in this field continued at an accelerated rate. Detailed reports were published on the mineral resources of the Libby area, Montana, containing descriptions of silver-lead, copper, and gold deposits; and on the Boise Basin, Idaho, containing descriptions of pyrite, base-metal, and gold deposits. Several short, detailed reports on various mineral resources in different states were also issued.

Other publications issued include a report on potential iron deposits in Michigan; 10 reports on copper and copper-zinc deposits in California; two short reports on small quicksilver deposits in California; a compilation of the geological resources of the Trinity River tributary area in Oklahoma and Texas; a preliminary report on the mineral resources of the Kirby area, Oregon; a comprehensive report on the chromite deposits in part of California; and a guide for an appraisal of the national mineral resources. Fourteen brief scientific research papers were also released including descriptions of new geochemical methods of research that may be used in the discovery of hidden ore bodies. In addition 23 preliminary reports or maps of mineral deposits were made available for public inspection at Geological Survey offices and libraries in various States.

Field work was completed on 6 projects and begun on 2 new ones. Field work on 39 long-range projects of geologic mapping and related investigations begun prior to July 1, 1948, continued throughout the year 1949.

The Geochemical Prospecting unit which is engaged in developing prospecting methods using chemical studies of soil, vegetation, and water, carried on experimental field work in search for ore in three mining areas in Arizona, two in Colorado, and one each in Utah, New Mexico, and Wisconsin. The results are encouraging and the techniques developed by this unit are now being tried elsewhere by the mining industry.

Petroleum and Natural Gas

The continuing objective of the Geological Survey work in the field of oil and gas investigations is to provide a flow of the needed basic geologic data in petroleum provinces and in those regions in which the character and thickness of the rocks are such that there is promise that petroleum or natural gas may be found. The data needed are principally stratigraphic, such as the presence or absence of source beds and reservoir rocks, the position and magnitude of regional changes in formations that might, at depth, cut out oil-bearing beds or produce stratigraphic traps, or lateral changes in the characteristics of formations that will have a bearing on the porosity of reservoir rocks.

It is the further objective of the Survey to make promptly and widely available the data resulting from these regional geologic investigations, so that they can be of use to all who are engaged in oil exploration and discovery. This objective is being achieved by the issuance of preliminary results in the form of maps and charts of the oil and gas investigations series as rapidly as possible, announcing their availability by press notices and by placing them on sale at a number of points throughout the country. At the end of the fiscal year, more than 115,000 copies of the maps and charts printed to date had been distributed by mail and over-the-counter sale, 25,000 of this number during fiscal year 1949. During the fiscal year 16 maps and charts were published in preliminary form and 30 reports were published by state surveys or in technical and trade journals.

At the end of the fiscal year 30 projects were in operation in 19 States including Oregon, California, Montana, Wyoming, Utah, Colorado, New Mexico, Oklahoma, Kansas, Arkansas, Michigan, New York, Ohio, Kentucky, West Virginia, Virginia, Georgia, Alabama, and Florida.

Oil Shale

The Geological Survey has continued its investigations of oil shale. Although this activity is small its future importance is large. Currently available knowledge of the quantity and quality of oil shale is still largely based on reconnaissance studies that were made by the Geological Survey 30 years ago. Because of the enormous potential importance of this large resource, improved knowledge is needed of the quality and availability of oil shale suitable for processing as a possible source of liquid petroleum products.

During the year detailed mapping and investigations of the rich deposits in the Parachute Creek-DeBeque area, Colorado, adjoining Naval Oil Shale Reserves 1 and 3 on the west were continued. One report was published, namely the results of a detailed study of Reserves 1 and 3, conducted in cooperation with the Navy. This report provides data for a reliable estimate of the oil reserves in oil shale in those reserves.

Coal

The Geological Survey is currently engaged in two closely integrated programs of geologic investigations of our coal resources, with the ultimate objective of obtaining a sound, complete, and adequate knowledge of our coal deposits. The first program consists of regional appraisals of coal reserves. These appraisals provide data on coal reserves in individual beds, and in several categories according to the thickness of the minable coal, amount of overburden, and reliability of information. The second program consists of detailed studies and mapping in selected areas where specific information is needed to facilitate mining or to locate new sources of coal, and to provide basic geologic data on which adequate resource data are founded.

During fiscal year 1949, reappraisal of the coal reserves of Montana was completed on the basis of published and unpublished data in our files, by rank of coal, by thickness of bed, and by counties. Similar reappraisals of New Mexico, Michigan, and Wyoming coal reserves were begun. Detailed geologic mapping of coal deposits was started in the San Juan Basin of New Mexico, in the Durango and Trinidad coal fields of Colorado, the Spotted Horse coal field of Wyoming, in Leslie County, Ky., and in Lewis County, Wash.

An extremely detailed map of the Coalwood coal field in Montana was completed, and maps of the Coosa field in Alabama and the Deep River field in North Carolina were published. Each of these is accompanied by detailed and accurate estimates of coal reserves by bed, by thickness of bed, and by depth of overburden where needed. A report on the Haskell County coal area, mapped under the joint auspices of the Oklahoma Geological Survey and the Federal Geological Survey, was printed and a similar report on Le Flore County, Okla., was in preparation for the press.

Exploratory drilling was begun in parts of the Yampa coal field, Colorado, where large areas remain as part of the public domain. This drilling may lead to new sources of good quality coal.

A notable accomplishment of the year was the completion of plans for a new coal geology laboratory at Columbus, Ohio, established with the generous cooperation of the Ohio Geological Survey and the Ohio State University. This laboratory will provide the facilities required for the highly technical paleobotanical and petrographic examinations of coals by specialists of the Geological Survey. These studies are needed as a guide to and a correlation of the geologic factors controlling variations in the quality of coals.

General Geology

Work in general geology by the Geological Survey includes not only the preparation of detailed geologic maps of quadrangles which contribute to the completion of the geologic map of the United States, but it also provides consulting service and research for the benefit of other Survey organizations in several distinct geological fields, such as structural geology, volcanology and related igneous phenomena, sedimentation, glacial geology, and agricultural geology. Compilation of comprehensive geologic maps of States and the preparation of State indexes to published geologic maps are also included in this activity.

During the fiscal year 1949 a geologic map of Idaho was completed and published, and maps of Montana and Oklahoma were nearly completed. Ten State indexes to published geologic maps and a report on the results of a detailed regional survey in Rhode Island were published. Thirty-five field projects were in progress at the end of the fiscal year, most of which are expected to continue through fiscal year 1950. Although these projects are not directed toward the investigation of specific mineral resources, many of them have yielded important data of immediate practical value, and the resulting maps and data are being used by various Government departments, State agencies, and the general public.

The operations of the Hawaiian Volcano Observatory, recently transferred to the Geological Survey from the National Park Service, continued with little change. Plans have been made to integrate the research activities of the observatory with volcanologic research being conducted by the Survey in other areas, including the Aleutian Islands and the Colorado Plateau. Such studies of volcanoes and related phenomena will eventually yield data that will permit the prediction of eruptions and certain types of earthquakes. A knowledge of volcanic processes and the ways in which all types of molten rock become emplaced in the earth's crust are essential to an understanding of many kinds of mineral deposits, and such knowledge can be used to locate additional deposits.

Geophysics

Geophysical methods of exploration are being used more and more as deposits of minerals and mineral fuels, most of which are not detectable by surface indications, become fewer. Applications of geophysical methods to geological exploration must be still more widely used if we are to maintain an adequate rate of discovery.

During the fiscal year 1949, geophysical surveys were made in connection with geological surveys in many areas of the United States and Alaska. These surveys included magnetic surveys primarily concerned with deposits of magnetic minerals or minerals associated with them, electrical surveys, gravity surveys, seismic surveys, radioactive surveys, and geothermal surveys. A vigorous program of research and development aimed at producing increasingly sensitive, precise, and powerful geophysical instruments and improved methods is being continued.

Production of aeromagnetic maps was increased some twentyfold during the past year. This was accomplished by further systematizing and standardizing the compilation of aeromagnetic data, by increasing the compilation staff about threefold, and by introducing a training program for new employees. The increased production has greatly reduced an accumulated backlog of aeromagnetic data and will permit prompt publication of current surveys. As examples, the greater part of the compilation of the State-wide survey of Indiana and of large parts of the Lake Superior and Adirondacks iron regions were completed. These surveys will furnish basic information to aid in exploring for oil and iron.

Other activities were subordinated to some extent because of the urgent need to organize and staff the aeromagnetic section as a balanced operational unit. The program of geophysical research and development and of ground geophysical surveys is therefore still inadequate to meet many requirements.

Of special interest was the geophysical ground-water program. Electrical resistivity surveys conducted by the Survey were successful in locating the depth and extent of water-bearing beds and of gravel deposits in a number of localities, thereby permitting a great reduction in the amount of drilling required to test these areas. This program was carried out in cooperation with geologists of the Water Resources Division.

Also of interest was an experimental electrical survey in southwest Colorado. Results indicate that geophysical methods can detect uranium-ore bodies in that area and thereby eliminate some costly drilling.

The field program carried out during the year included 12 aeromagnetic surveys in 10 States and covered 30,865 square miles. Twelve gravimetric and electrical surveys were made in 7 States and in Alaska.

Geochemistry and Petrology

Work in geochemistry and petrology, carried on largely in the laboratory, is an essential part of the Geological Survey's program of geologic mapping and mineral-resources investigations. Its function is to determine for the field geologists the mineralogical and chemical composition of the rocks, ores, and minerals being investigated; to conduct researches into methods of analysis and mineral identification, physical and chemical properties of minerals and rocks and their relationship; and to study their modes of origin in the field and in the laboratory. An outstanding accomplishment during the year was the modification of the flame-photometer method, making possible rapid and accurate quantitative determinations of alkalies in rocks and minerals.

Working in concert with the field unit engaged in geochemical prospecting, the geochemical laboratory is developing methods for determining in the field minute amounts of various elements. Already satisfactory methods for the determination of zinc, copper, molybdenum, vanadium, nickel, and lead have been developed. A new and simple device for making semiquantitative spot tests, named the "chromograph," was designed, tested, and found to give good results With this device, it is now possible to make in the field rapid and sufficiently accurate analyses for minute traces of copper and nickel, giving the results in a form that can be preserved as a permanent record. The use of the chromograph eliminates the delay and expense of sending samples to the laboratory and permits immediate concentration of field effort on promising areas. Chromographic methods for other elements are also being devised. It is expected that this method will have important applications not only in prospecting for ore, but also in agricultural studies of soils.

The spectrographic method of analysis has become increasingly useful, and research in our laboratory has improved its accuracy. During the past year, it has been the mainstay of our search for beryllium, and the standards set by our laboratory have aided commercial laboratories to improve their analytical results.

The laboratory identifies and studies samples that require special techniques using optical, chemical, X-ray, and spectrographic methods. Our library of X-ray powder patterns now contains over 4,000 films, hence almost all naturally occurring materials can be identified quickly. Differential thermal analysis curves are another new and useful means of determining the composition of many minerals that are otherwise difficult to identify. All of the methods developed in the Geological Survey laboratories to identify the components of rocks and ores are made available to industry, research scientists, and to the public. During the past year, important contributions to mineralogy were made, including descriptions of seven hitherto unknown minerals, and new data have been made available on many others. Three of the minerals were new uranium compounds, and they represent an important addition to our knowledge of the forms in which this element occurs.

Paleontology and Stratigraphy

During the fiscal year 1949, supporting research was continued on a consulting basis for other branches and divisions of the Geological Survey, and in addition a program of basic research was continued.

The paleontological staff of the Geological Survey in the last few years has not been increased at a rate commensurate with the growing need for its services, and a large backlog of requests for consulting services has accumulated. At present, every effort is being made to increase this activity and to bring it into balance with the rest of the program.

Direct contributions were made to the solution of many problems arising during the investigations for oil and gas, coal, and various metalliferous and nonmetalliferous mineral deposits through the visit or assignment of specialists to some 30 field parties.

Engineering Geology

Production of geologic maps and the interpretation of those maps in terms that are understandable and useful to engineers is one of the functions of the Geological Survey. The civil engineer builds his structures on or below the earth's surface; part or all of his foundation structures are made of natural materials which he must find locally. It follows that the more he knows about his part of the earth's surface, the better his structure will fit into the limitations imposed by nature and the better, safer, and cheaper will be his final product. This is true whether he is building a farm access road or a super highway, a skyscraper or a dam, a tunnel or a levee.

The Geological Survey did not begin this work in engineering geology until fiscal year 1946. The next several years were ones of slow growth and of trial and error in an effort to determine the proper scope of engineering geology in the Geological Survey. Fiscal year 1949 saw the fruition of much of the earlier work and the crystallization of many of the ideas developed during this period. The existing lack of basic data on topography, geology, hydrology, and soils in planning major Federal construction activities has been highlighted recently by the Hoover Commission in its report on natural resources, and indicates the urgency of increasing this small program developed by the Geological Survey in the last few years.

Some of the results obtained by the program of engineering geology are briefly described. It has been found that a device originally designed to rivet plates to damaged hulls of ships may be a useful field tool in measuring the engineering properties of rock. Tests that have been made indicate that the device will measure quickly and accurately the toughness, porosity, and even weight per cubic foot of dry and water-saturated rocks. It is hoped that further work now in progress will eventually serve to do away with some of the costly laboratory tests on rock now used by engineers.

Since 1946 a continuing investigation of the construction materials of northern Kansas has been carried on in cooperation with the State Highway Commission. By the end of fiscal year 1949, 17 counties had been mapped, and reports on most of these were published or made available to interested Federal and State agencies. The maps that accompany these reports are on a scale of 1 mile to the inch. They show all the rock units in the county, including overburden and other unconsolidated materials, and describe them in terms of their use for concrete aggregate, road material, riprap, and many other construction purposes.

During fiscal year 1949, the Geological Survey entered into a cooperative agreement with the Corps of Engineers to make a survey along the Snake River in Washington. The immediate objective is to produce highly detailed geologic maps of a strip along the river, 80 miles long and 3 miles wide. As the Corps of Engineers expects to build several large power and navigation dams within this strip, detailed knowledge of the rock conditions is needed, not only in planning the dams and power plants, but also in relocating many miles of railroads and highways. As soon as the strip mapping is completed, it is planned to expand the area covered by preparing standard geologic maps (with subsurface interpretation) of four 15-minute quadrangles. Here, as elsewhere, it is the aim of engineering geologic mapping to produce maps and engineering data that will have permanent, rather than transitory value. Therefore, these maps will contribute to the industrial development which will certainly follow the development of the river.

In addition to the projects outlined above, the Geological Survey carried on 17 projects in engineering geology in 11 States, Alaska, and Puerto Rico during the fiscal year.

Geologic Investigations in Alaska

In spite of the fact that the mineral industries rank second among all the industries in the Territory of Alaska, the geologic mapping and mineral investigations program of the Geological Survey in the Territory is small and must be greatly increased if the best interests of the Territory are to be served. Only about 49 percent of the Territory has been geologically mapped by reconnaissance methods, and only a fraction of 1 percent has been mapped in detail. For example, the area in which petroleum may possibly be found is more than 250,000 square miles, and yet only 11,000 square miles have been mapped geologically on an adequate scale. Greater deficiencies in geologic information can be cited with respect to coal, platinum, chromium, and most other minerals.

In fiscal year 1949, three reports on the geology of mineralized areas in Alaska were completed and transmitted for publication in bulletin form. These reports describe investigations of garnet deposits in southeastern Alaska, copper deposits in the Prince William Sound area, and the geology and miscellaneous mineral occurrences of the eastern Alaska Range.

In addition, several memorandum reports on limestone, raw material for cement manufacture, the Alaskan continental shelf, and general mineral commodity information have been made available to other governmental agencies.

In southeastern Alaska, field work was concluded on the northwestern Chichagof area, where deposits of copper, gold, molybdenum, and tungsten are known, and on the limestone deposits of Heceta Island. Petroleum investigations were concluded in the Iniskin Peninsula area of the Alaska Peninsula, and further investigations were begun northward along the Alaska Peninsula from Iniskin Bay to Tuxedni Bay, to delimit additional specific areas favorable for oil accumulation and warranting further detailed studies.

New projects were begun in Mt. McKinley National Park and in southeastern Alaska in the Juneau-Chichagof area, and on the southern portion of Prince of Wales Island. Both areas contain known mineral deposits of potential significance.

Investigations were continued in the Juneau gold belt, the Kenai and Nenana coal fields, the central Kuskokwim region which contains a number of mineralized areas, the Willow Creek mining district, and on petroleum possibilities in the Gulf of Alaska area.

Investigations of the limestone deposits of Heceta Island, undertaken to obtain partial coverage of part of the extensive belt of limestone in southeastern Alaska, have now been completed. The results of these investigations are of particular importance because of the scarcity of high-grade limestone on the Pacific coast and the easy accessibility of these deposits to Seattle and other Pacific ports.

A manuscript report on the coal reserves of the Homer district of the Kenai coal field was completed at the close of the fiscal year and is now being prepared for release to the public in mimeograph form for use by those engaged in land-leasing and settlement problems, and by those interested in the development of coal deposits.

The latter report contains the results of almost two decades of investigations in the eastern Alaska Range. During that period, field studies of individual localities within the area were completed, and this knowledge has now been incorporated into one volume. As in Bulletin 862, The southern Alaska Range, this will mean that a geologic picture of a significant unit of the Territory can now be presented, not only for the use of the scientist interested in the geologic background of the Alaska Range, but also for the benefit of the prospector and engineer interested in the development of the mineralized areas described in the bulletin or in the search for additional deposits in areas that appear geologically favorable.

In southeastern Alaska, field work was concluded in the northeastern Chichagof area, where there are known deposits of copper, gold, molybdenum, and tungsten. These studies show that prospecting for lode gold should be extended far beyond the vicinity of the three developed mines. A preliminary report now in preparation will afford a guide for more extensive prospecting in the area. Similar detailed studies being continued in the Juneau gold belt promise to reconcile many of the discrepancies existing after earlier and separate investigations at opposite ends of the area were made. Many facts concerning the apparent control of mineralization that previously have not been available will be placed on record to guide further prospecting in this once highly productive area.

Military Geology

The Military Geology branch conducted an intensified program of research and report preparation and field work in the fiscal year 1949. Its activities were centered mainly in a research group working in Washington, an Alaska permafrost section, and a staff engaged in geologic surveys in the Pacific islands. The military geology program is conducted principally under a cooperative agreement with the Military Intelligence Division, Office of the Chief of Engineers, and operates wholly on funds transferred from the National Defense Establishment.

The Washington group produced 13 comprehensive intelligence reports for the Corps of Engineers, and prepared, in addition, 24 special reports. These reports deal with such subjects as terrain analysis, water supply, construction materials, airfield sites, construction of underground installations, and the bearing of geologic factors on various military operational problems.

In Alaska, field studies on permafrost and other terrain features were conducted on Seward Peninsula, St. Lawrence Island, Yukon River, Kuskokwim River, and in the Fairbanks area. Three reports on permafrost investigations in Alaskan areas were completed. Investigation of airfield sites were conducted in six areas, and reports were prepared on each area.

The Pacific island program saw the completion of field geologic mapping of Okinawa, Palau, and Saipan. Substantial progress was made in the preparation of military geologic folios on these areas. Nine reports on general geology, mineral resources, subsurface conditions at airfields, engineering geology, and earthquake effects in the Pacific region were completed. Four further reports were near completion at the end of the fiscal year.

Other activities included work on the preparation of a military geologic folio of Fort Benning, Ga. All data have been gathered and completion of the folio is expected during the fiscal year 1950. A field and office project was begun in the western United States, with the purpose of preparing a military geologic folio of the Sixth Army Area. Three geologists were assigned to the Engineer Division, European Command, United States Army, as special consultants. Their assignments were completed during the fiscal year.

Foreign Geologic Investigations

Geologic investigations in foreign areas, carried on by the Geological Survey under the sponsorship of the Department of State, result from mutual cooperative agreements between this Government and the various foreign governments. The projects under this program are determined by mutual national or scientific interest or the needs of local (foreign) industries. Projects range from first reconnaissance in underdeveloped areas to the detailed study of partly developed areas and are aimed at the discovery of deposits, the extension of reserves of known deposits, or the opening of new deposits in developed mineralized areas.

During the fiscal year 1949 the foreign geologic investigations resulted in the completion and publication of nine foreign mineral studies as follows: Talamantes manganese deposits, Chihuahua, Mexico; a country-wide survey of Mexican optical calcite deposits; a study of the Guadalcazar tin-bearing placer deposits in the Mexican State, San Luis Potosi; the Soyatal antimony deposits in the Mexican State of Queretaro; Camamu Bay barite deposits in the Brazilian State of Bahia; and a study of tungsten deposits of north-central Chile. Other mineral-deposit investigations were carried out during the year in Mexico, Brazil, Peru, Philippine Republic, and Afghanistan, the results of which will be available during the coming fiscal year. Groundwater investigations in Panama and Haiti were completed, and the resulting reports are on open file in the Geological Survey.

A second phase of the Geological Survey's foreign program is designed to train the more promising young technicians from the underdeveloped mineral areas of the world. The organization from which these men are drawn are usually in the formative stage and somewhat lacking in both technical and administrative experience on which to build. While scientific and technical aspects of their inservice training are given the most attention, they are also given a thorough review of the Survey's administrative practices and organizational procedures in long-range planning for country-wide geological surveys and mapping. Therefore, these young technicians, as a result of this training, will be able to take advantage of much of this experience in forming their own geological institutes. A total of 10 in-service trainees from 6 foreign countries served their internship with the Geological Survey's field parties in the United States and in the laboratories at Washington, D. C.

Geologic Maps

During the year the Office of Geologic Cartography in Washington, D. C., in conjunction with 5 of its field units operating in Boston, Denver, Knoxville, Salt Lake City, and Spokane, prepared 1,822 geologic maps, charts, diagrams, and other illustrations for multicolor and black-and-white reproduction. Preliminary work was started on the preparation of the Brockton and Mount Toby, Mass., geologic quadrangle maps, showing surficial and bedrock geology for each, as well as the Antler Peak, Mount Tobin, and Winnemucca, Nev., quadrangles. All of these maps will be published as part of the new series of geologic quadrangle maps.

The map editor reviewed and edited 410 maps and figures prepared for Geological Survey publications, and 266 maps and figures for trade and technical journals. In addition, more than 450 maps and figures were given preliminary review, and 82 maps and figures for circulars and open file reports were edited.

The new list of map symbols printed in June 1948 was widely distributed among geologists; an edition of 4,000 copies was exhausted and 6,000 additional copies were printed in November. The new rock-color chart for field use, prepared in cooperation with other geologic organizations, was published in July.

Library

The fiscal year 1949 was the most active in the history of the library, as reader use and loans to members of the Geological Survey exceeded the peak war year. Nearly 16,000 readers used the library personally, an increase of about one-fourth over last year. This increase was entirely by Survey personnel, as non-Survey readers decreased slightly.

As in the past 2 or 3 years, a larger number of volumes were sent to men in the field, which has hampered the service in Washington. Some progress has been made in building up the collections in the Denver and the Spokane offices to ameliorate this situation, but a great deal more needs to be done, and plans for the expansion of facilities in the field are being made for next year.

Accessions for 1949, a total of 24,067 pieces, exceeded those of any previous year, and indicates the revival of geologic publication following the curtailment during the war. It also reflects the receipt of material from abroad in greater quantity, but is also evidence of the broadened scope of the Survey's work.

While the quantity of geologic publications from abroad is not so large as before the war, we have, with the one notable exception of Russia, received what is published. Correspondence with each former exchange has reestablished those exchanges now publishing reports.

Our current material is going forward regularly, but a part of the wartime accumulation remains to be sent to foreign exchange.

The Bibliography of North American Geology for 1946–47 was delivered in May after some delay due to printing difficulties. In May 1949 it was determined to publish the bibliography annually, and the bibliographic staff, by putting their full effort on this work, had the 1948 bibliography ready for the printer at the close of the fiscal year. It will be ready for distribution by late fall.

TOPOGRAPHIC DIVISION

Topographic maps provide fundamental information which is needed in intelligent study and planning for the conservation and development of our natural resources, the expansion of our industrial facilities, and many problems relative to the Nation's military security and economic welfare. The availability of accurate, up-to-date topographic maps for these purposes usually results in saving of time, effort, and funds so great that the original cost of their preparation is outweighed many times.

Government and State agencies, industrial concerns, educational institutions and organizations, local government units, and a considerable segment of the general public are becoming increasingly conscious of the fact that it is plainly good business to have adequate topographic maps. Consequently the demand for mapping, which necessarily includes the revision of old outdated maps as well as the preparation of new ones, continues to increase.

Topographic mapping completed up to the present time covers only about half of the United States. Much of this coverage is so old or unsuitable for present-day requirements that adequate maps are available for less than 25 percent of the country. Furthermore, as the maps become older, they become more obsolete and, unless they are revised, must be relegated to the unsuitable category. A long-range, coordinated mapping program must, therefore, include provisions not only for new mapping but also for overcoming the obsolescence of existing maps. A plan for completion of the topographic map of the United States during a 20-year period and the maintenance of the maps through periodic revision has been prepared. The achievement of this objective is dependent on the availability of adequate funds.

Operations of the Topographic Division are principally conducted through the Atlantic, Central, Rocky Mountain, and Pacific regions, with regional headquarters at Arlington, Va.; Rolla, Mo.; Denver, Colo.; and Sacramento, Calif., respectively. The Rocky Mountain region includes Alaska. Staff activities and special projects are conducted in Washington. The responsibilities of the various staff sections and the over-all accomplishments of the division are described as follows.

Plans and Estimates

The Plans and Estimates Section is responsible for the preparation of over-all work programs, involving general plans for the distribution of funds and detailing personnel between the regions in order to balance capacities with work load and allotments, and the preparation of the annual budget for carrying on immediate and long-range mapping programs.

An analysis was made of map needs as submitted by 15 Federal agencies through the Bureau of the Budget, and the results of this review were integrated with special requests as received from various map-using State agencies and other sources for the preparation of the 1950 mapping program. Information on mapping programs was exchanged with various departmental field committees, and information received from the committees regarding topographic mapping needs were integrated with other mapping requests. Estimates and plans for various proposed State cooperative programs were prepared in conjunction with the region offices. These efforts resulted in the establishment of new cooperative programs in Kentucky, Tennessee, Minnesota, and Iowa. Mapping activities in Alaska were stepped up in line with military requirements and civilian requests. The long-range program of topographic mapping for the Territory is being coordinated with the National Military Establishment, civilian agencies, and the Alaskan Field Committee. At the request of the Governor of Hawaii, preliminary steps were taken toward revision of some of the maps of the Territory which were made two or three decades ago.

Production Control

The Production Control Section, which is generally concerned with production has three major responsibilities: (1) To chart and follow production schedules and status; (2) to chart and analyze work loads and capacities, and to recommend appropriate action in connection therewith; (3) to assemble, analyze, and distribute data on operational costs. Cost data based on 2 years of mechanical tabulated data were made available for all phases of mapping. Regional studies on level rates of production were accomplished and used in recommending redistribution of personnel and equipment.

This year the section strengthened existing policies on status and scheduling, and formulated methods for the measurement of workload and phase capacities. An assembly of the Plans and Production Sections chiefs from the four region offices was held during the year to unify plans and production policies and procedures.

Geodetic Surveys

The Geodesy and Control Surveys section is responsible for the establishment of uniform standards for control surveys and for research in new control-survey methods. During the year these objectives were furthered by the preparation of technical instruction manuals, by inspection trips to current control projects in the regions, by numerous visits to research laboratories maintained by other Government agencies and private industry, and by experiments with new instruments and field procedures.

Geodetic surveys completed in the four regions included approximately 9,700 miles of transit traverse, 21,300 miles of spirit leveling, and an amount of triangulation sufficient to provide horizontal and partial vertical control for 24,500 square miles of topographic mapping. Triangulation projects were successfully conducted in Alaska and in the Rocky Mountain region with the aid of helicopters to transport men and instruments to the station sites. Lists of the adjusted results of control surveys were published for transit traverse on thirty-six 15-minute quadrangles, for levels on one hundred and sixty-one 15-minute quadrangles, and for triangulation on five 15-minute quadrangles.

A circular entitled "State Coordinates and Polyconic Maps" was published for general distribution. Tables and instructions for quick conversion of geodetic coordinates to State plane coordinates were computed and published for areas representing about 20 percent of the continental United States. Computation of these tables will be continued until they are completed for the entire country and they will substantially decrease the cost of this phase of computing. Tables for the projection of polyconic maps for the two new series of maps to be issued for Alaska were computed and reproduced.

The polastrodial, an instrument which offers a quick mechanical solution for astronomic azimuths based on observations of Polaris, was constructed and placed in operation in the geodetic unit of the Atlantic region. Tests of two commercial elevation meters were made in actual field operations. These instruments, which are transported in an automobile or trailer, are used for the rapid determination of many of the fourth-order elevations required for map control. Extensive experiments were conducted to determine the relative speed and economy of several new or improved methods of measuring distances for transit traverse. Continuous effort was made to keep abreast of new developments in the use of shoran so that this electronic method of distance measurement may be applied to control surveys as soon as advancement in its techniques attains the required precision.

Photogrammetry

The Photogrammetry section has four primary responsibilities: The development of new photogrammetric instruments and equipment and the investigation of existing equipment; the procurement, distribution, and installation of this equipment, with instructions when necessary for its use; the investigation of existing photogrammetric methods and the development of new methods, including the formulation of techniques and procedures; and the procurement of aerial photography, including the preparation of specifications, administration of contracts, and the inspection and acceptance of materials.

The Kelsh plotter has been modified to incorporate the use of wide-angle photography. A few of these plotters have now been distributed to the region offices for production trials and are proving most satisfactory in the preparation of maps from aerial photographs. Tests have been made of certain features of a new plotting instrument, using special photography, and the results to date are favorable. The final pilot model incorporating several improvements is now under construction. A captured German lens of near distortion-free characteristics has recently been duplicated successfully by a commercial firm as a result of a cooperative agreement involving a development contract to be awarded by the United States Air Force. This lens, when produced in quantity, is expected to have a marked influence on all mapping activities of the Topographic Division. New developments in camera and lens testing which are performed before the award of aerial photography contracts and also during the execution of the contract have resulted in more accurate photographs.

During the year much effort was directed toward a more thorough understanding between the aerial photographic contractors and the Geological Survey in an attempt to solve many mutual technical problems. This has also resulted in photography of higher precision and quality which should further insure greater economy in mapping. All of these efforts in devising new plotting instruments and methods have been directed toward decreasing the cost of mapping while maintaining approved accuracy standards.

A cooperative project with the Department of the Navy resulted in the procurement of 59,000 square miles of photography suitable for standard mapping. Of this total, 40,000 square miles was in southeastern Alaska, 5,000 square miles in central Alaska, and 14,000 square miles in Naval Petroleum Reserve No. 4. Liaison with the United States Air Force, in connection with photographic coverage areas in Alaska, was maintained throughout the year.

Approximately 72,000 square miles of photography in continental United States was delivered during the year, and contracts were placed for approximately 57,000 square miles of new photography.

Topographic Surveys

The Topographic Surveys Section continued the preparation of new or revised instructions intended to achieve all practicable standardization of the procedures and products of the four field regions. Technical memoranda covering public-land lines, contouring special features and elevations for publication, were issued. Also issued in provisional form were instructions for map-accuracy test surveys, a manual on supervision and training, and a topographic mapping training manual. Considerable progress has also been made in the first draft of a revision of section E, Bulletin 788, Topographic Instructions.

A series of universal plotting scales was designed to cover all map-compilation needs of the Topographic Division. For the purpose of standardizing topographic maps, inspections of field-completion operations were made in two of the four regions. A member of the section has served as chairman of a committee on map classification. During the year the committee has appraised and classified all other-agency maps received by the Geological Survey for distribution. About half of the Survey's maps have also been reclassified in accordance with the same appraisal standards.

Cartography and Map Editing

The section of Cartography and Map Editing has two broad responsibilities: (1) Technical control of cartography in regard to map-finishing procedures and the determination of style, symbolization, and quality of the finished product; and (2) inspection, in the form of review editing, to assure that all maps produced conform to approved standards. The accuracy and completeness of copy, as well as suitability for reproduction, are examined.

Reorganization of the cartographic activities to fulfill current program requirements was concluded during the year. The expanded mapping program made it necessary to decentralize map-finishing work and have these operations accomplished in the regional offices where the preceding phases of map production are performed. A group of staff cartographers in Washington now reviews all maps prior to reproduction and advises regional offices regarding their findings of error or departures from adopted standards and established conventions. The standardization of map treatments, styles, and symbolizations, recently accomplished in collaboration with other agencies, has been incorporated in Geological Survey practice. Considerable progress has been made in preparing and publishing the topographic mapping originally accomplished by other agencies for special purposes. Such map data as are useful to the public is now published and distributed by the Geological Survey for the convenience of map users who may now look to one agency for their topographic map requirements.

Research for improvement of cartographic techniques and drafting mediums is a continuing project. Various plastic sheetings, as well as special inks required for these drafting surfaces, were tested. Investigations were continued for possible improvement of map-lettering facilities and other elements affecting the refinement of the finished product. Copying camera facilities are now available for each regional office. This will make it possible in the near future to discontinue the practice of printing press-plate proof and will, in turn, considerably extend our map reproduction capacity and shorten the elapsed time required for map printing.

Map Information

The Map Information Office was confronted during the year with an increasing volume of requests from Federal and State agencies, as well as the general public, for information regarding maps of all kinds, aerial photography, and control data. The volume of mail increased by 30 percent. A commensurate increase was noted in personal visits and telephone calls. While all segments of the public were represented, a major proportion of requests originated from scientists and engineers engaged in research, exploration, and development projects. Numerous inquiries were received for map information to be included in papers, bulletins, and technical journals. Also in evidence was an increase of requests from colleges, universities, and various other educational and institutional organizations. In addition to distributing information outside of the Survey, one of the principal functions of the office is that of providing other units of the Geological Survey with map data needed in their normal operations.

Publications prepared by this office for free distribution now include status index maps covering the five main subjects—topographic mapping, aerial photography, aerial mosaics, horizontal control, and vertical control in the United States, its Territories, and possessions.

Indexes of horizontal and vertical control were published for the first time during the year. A master series of State index maps showing horizontal and vertical control has been prepared for nearly all States. Photostatic copies of these indexes are available for a slight charge. The fourth edition of the index showing the status of topographic mapping was issued as two maps—one showing large-scale mapping, i. e., mile-to-the-inch and larger, and the other showing reconnaissance mapping. Such treatment was necessary since it is practically impossible to show detailed information concerning nearly 10,000 quadrangles on an index of the size now in use. Material was prepared for printing the fourth edition of the map showing status of aerial photography. A revised edition of the status map showing aerial photography of Alaska was prepared for printing. This index is available only to Government agencies for official use.

The series of master base maps of aerial photographic coverage was increased to 13—10 for the holding of Government agencies and 3 for showing the photography held by State agencies and commercial concerns. There was considerable increase in voluntary reports from the State and commercial groups. This series represents a complete cumulative inventory of aerial photography of the United States which (including duplications) now totals well over 6,000,000 square miles of coverage. The date of photography, focal length of lens, scale, and area covered are shown. Photostatic or photographic reproductions of these base maps are available.

The supplying of photographic or photostatic copies of map manuscripts and various master base maps mentioned above, as well as other office records, has become a major item. The increasing demand for such data in advance of publication is attested by the fact that during the year 1,665 requests involved 11,350 prints. The sales amounted to $9,793.02. Requests for reproductions from aerial photographs held by the Geological Survey have increased considerably. During the year, total sales amounted to $42,143.73. The volume of sales in 1948 was $24,326.55. Prints are now processed in the four regional laboratories—Arlington, Va.; Rolla, Mo.; Denver, Colo.; and Sacramento, Calif.

The effectiveness of the service rendered by the Map Information Office to the Geological Survey, Government and State agencies, and the public is wholly dependent on two factors—a reliable system whereby all groups promptly and accurately report their new holdings in the subject activities and adequate methods in the Map Information Office for receiving, collecting, and classifying the data and assembling them into suitable form from which status indexes can be compiled and from which the more detailed data for specific requests can readily be furnished. Much was accomplished during the year to further perfect the flow of reports from all sources which prepare or acquire maps, aerial photography, and control. Conversely, in order to avoid duplication of effort, all agencies are now looking to this office for comprehensive information before new work is undertaken in topographic mapping, aerial photography, aerial mosaics, and control work.

The scheduling of motion-picture films on mapping and the preparation of mapping material for display at technical gatherings have continued to be important items. During the year the training film "Topographic Mapping by Photogrammetric Methods" was shown 88 times before technical and educational societies, colleges and universities, and service groups. It is estimated that the film was viewed by nearly 10,000 persons.

Continuing interest is shown by foreign engineers in Geological Survey mapping methods. During the year the Survey was host to visitors from China, India, Siam, the Philippines, Turkey, Switzerland, France, Belgium, Scotland, England, Argentina, Brazil, Chile, Ecuador, Guatemala, and Canada.

Mapping Accomplishments

During the year topographic mapping was carried on in 44 States, Alaska, and Puerto Rico. Cooperative projects were conducted with 23 States, the Tennessee Valley Authority, and Puerto Rico.

The mapping of eighty-one 15-minute quadrangles and three hundred and twenty-two 7½-minute quadrangles was completed, and field compilation was in progress on thirty-one 15-minute quadrangles and one hundred and seventy-three 7½-minute quadrangles. In addition, work on 1,130 quadrangles was progressing in phases preliminary to field compilation. Subsequent phases of mapping were in progress on 670 quadrangles. In all, mapping was carried forward on 2,407 quadrangles.

Of the 651 maps reviewed and forwarded for reproduction, 635 were prepared for multicolor photolithography and 16 for copperplate engravings; 416 quadrangle maps, 13 State base maps, and 25 State index maps were prepared for reprint editions. At the close of the year, maps in process of reproduction included 19 for copperplate engraving and 165 for multicolor photolithography. Maps being reviewed, or awaiting review by the editors at the close of the year, totaled 107; and 978 maps were being carried on the agenda for reprinting. Of these maps, only 32 were actually out of stock, and these are now on the priority list for immediate reprinting.

For the Corps of Engineers, Department of the Army, mapping of Camp Carson, Colo., Fort Leavenworth, Kans.-Mo., and Fort Francis E. Warren, Wyo., was completed, and basic control was completed on the Fort Bragg Extension, N. C.-S. C., and Fort Sill, Okla. Sixty-two quadrangles, compiled by the United States Coast and Geodetic Survey, were drafted and prepared for reproduction.

The Trimetrogon Section has continued mapping and charting by the trimetrogon method for the United States Air Force. This method, developed at the beginning of World War II by the Geological Survey in cooperation with the Air Force, has been so satisfactory that several million square miles of planimetric and topographic charting has been accomplished in the areas which previously were either partly mapped or entirely uncharted. The work is performed on a reimbursable basis. The over-all program, of which this work forms an important part, is one of maintenance of adequate world coverage of aeronautical charts, primarily in the interest of national defense. It calls for a periodic review of all existing aeronautical charts with a view to progressive revision or recompilation of those charts which current world affairs indicate are of primary importance. In the current charting program, the development of new weapons and new military strategy requirements has continued to demand increased precision.

While chart priorities are established by the United States Air Force, as are all detailed specifications and other technical requirements, the Geological Survey conducts the editorial review and evaluation of charts and, upon request, prepares by photogrammetric methods revised or recompiled base charts preliminary to photolithographic reproduction.

The section also maintains the only existing world-wide reference library of trimetrogon photographs. This library contains several million oblique and vertical photographic prints from which is obtained the basic information for its charting work, as well as reference data required by other organizations whose activities include geology, forestry, water resources, construction, engineering development, or national defense.

During the year, the section completed more than 538,000 square miles of entirely new photo compilation. It also completed photorevision of nearly 226,000 square miles of charts and more than 118,000 square miles of cartographic compilation, making a total of more than 882,000 square miles. This charting covered areas of practically every part of the world involving a total of 146 charts, as follows:

Preliminary charts at scale 1:250,000 (foreign)	85
World aeronautical charts at scale 1:1,000,000 (foreign)	15
Pilotage and preliminary charts at scale 1:500,000 (foreign)	14
Approach and landing chart at scale 1:250,000 (foreign)	1
Photomosaics (foreign)	4
Special charts	16
Charts at scale 1:100,000 (foreign)	11

In addition to these, there are 205 similar charts in various stages of completion currently under way.

Special photo-mosaics were prepared for the use of the United States Navy Task Force 39 in their procurement of geographic control in Antarctica; and the compilation of 33,825 square miles of photography was completed for Operations Highjump.

Throughout the year, assigned research was carried on for the military and naval forces with a view to establishing the limits of accuracy of present operations and evaluating the effectiveness of certain modifications in instruments and procedures. One of the outstanding research assignments demonstrated that radar-scope photography could be used to establish horizontal control and that for areas where aerial photographs cannot be obtained, useful cartographic information could be extracted from radar photographs to produce a map. Another special research project was the compilation of a large-scale topographic map of the Grassy quadrangle, Utah. Successful completion of this project demonstrated the feasibility of producing inch-to-the-mile maps, using a photo-alidade to establish supplemental control with oblique photographs.

The Special Map Projects Section is engaged in the compilation and preparation for publication of state, sectional, and regional maps on scales of 1: 250,000, 1: 500,000, 1: 1,000,000, and smaller scales.

Compilation and inking on the international map of the world, scale 1: 1,000,000, has been temporarily suspended. Miscellaneous work prior to publication was done on the following sheets: Lake Erie (K–17); Cascade Range (L–10); Mount Shasta (K–10); Austin (H–14); and Los Angeles (I–11). The Los Angeles sheet was transmitted for publication. In addition to these, there are seven sheets in various stages of reproduction in the Branch of Map Reproduction. The Chicago (K–16) sheet was published.

The preparation of transportation maps for the Bureau of Public Roads was continued. Work was in progress on these maps for the States of Alabama, Indiana, Missouri, Mississippi, Louisiana, Kentucky, and Tennessee; eight sheets of Alabama, eight sheets of Indiana, and nine sheets of Louisiana were forwarded for reproduction; eight sheets in Virginia, one sheet of Washington, D. C., and vicinity, and five sheets in West Virginia are in various stages of reproduction.

The revision of State base maps, scale 1: 500,000, for Illinois, Iowa, Oklahoma, Indiana, Mississippi, and New Hampshire-Vermont was in progress during the year. Base maps were published for Wyoming, Massachusetts-Rhode Island-Connecticut, New Jersey, and Maryland-Delaware. Highway and shaded-relief editions for those States are pending.

A special edition of the 1: 30,000 scale series of Puerto Rico quadrangle maps showing barrio boundaries was published. Maps of Puerto Rico and surrounding islands on scales of 1: 120,000 and 1: 240,000 were in progress.

Areas mapped during fiscal year 1949 for publication at standard scales

[Contour intervals from 5 to 100 feet]

State	Scale			New mapping	Remapping	Revision	Amount of new mappipg to June 30, 1949	Total square miles in State	Percent complete
	1:24,000	1:31,680	1:62,500						
Alabama	744				744		26, 921	51, 609	52. 2
Arizona	501		1, 083	477	1, 107		35, 664	113, 909	31. 3
Arkansas	16				16		24, 881	53, 102	46. 8
California	3, 226		783		2, 797	1, 212	133, 076	158, 693	83. 9
Colorado	1, 338			329	951	58	58, 692	104, 207	56. 3
Connecticut		1, 037			905	132	5, 009	5, 009	100. 0
Delaware							2, 057	2, 057	100. 0
District of Columbia	6					6	69	69	100. 0
Florida	806	40	831	1, 677			13, 626	58, 560	23. 3
Georgia			246		246		25, 202	58, 876	42. 8
Idaho	858		50	722	186		39, 958	83, 557	47. 8
Illinois	708		3, 733	513	554	3, 374	51, 423	56, 400	91. 2
Indiana	691		227	[1] 706		227	11, 119	36, 291	30. 6
Iowa	21		201	201	21		14, 434	56, 280	25. 6
Kansas	232		636	459	409		66, 311	82, 276	80. 6
Kentucky	217			217			28, 022	40, 395	69. 4
Louisiana			504	504			20, 614	48, 523	42. 5
Maine			53	53			26, 335	33, 215	79. 3
Maryland	278				95	183	10, 577	10, 577	100. 0
Massachusetts		630				630	8, 257	8, 257	100. 0
Michigan	352		194	546			18, 942	58, 216	32. 5
Minnesota							9, 576	84, 068	11. 4
Mississippi							10, 032	47, 716	21. 0
Missouri	1, 650		467		1, 811	306	64, 498	69, 674	92. 6
Montana	186		754	890	50		40, 987	147, 138	27. 9
Nebraska	173		6, 058	5, 786	445		35, 227	77, 237	45. 6
Nevada			907	345	562		44, 510	110, 540	40. 3
New Hampshire							9, 304	9, 304	100. 0
New Jersey							7, 836	7, 836	100. 0
New Mexico	664		60	538	186		37, 338	121, 666	30. 7
New York	973	28			1, 001		49, 576	49, 576	100. 0
North Carolina [3]	15		212	15		[2] 895	19, 779	52, 712	37. 5
North Dakota [3]	2, 497		406	1, 613	1, 290		22, 543	70, 665	32. 0
Ohio	7			7			41, 222	41, 222	100. 0
Oklahoma	4		245		249		41, 901	69, 919	59. 9
Oregon							37, 304	96, 981	38. 5
Pennsylvania	142			56	49	37	45, 166	45, 333	99. 6
Rhode Island		70				70	1, 214	1, 214	100. 0
South Carolina							17, 098	31, 055	55. 1
South Dakota	267				267		20, 750	77, 047	26. 9
Tennessee							26, 778	42, 246	63. 4
Texas	885		814	1, 379	63	257	96, 485	267, 339	36. 1
Utah	374			317	57		20, 818	84, 916	24. 5
Vermont	26			26			9, 391	9, 609	97. 7
Virginia							38, 097	40, 815	93. 3
Washington			1, 970	1, 462	508		46, 225	68, 192	67. 8
West Virginia	56		51		56	51	24, 181	24, 181	100. 0
Wisconsin [3]			741		741		21, 453	56, 154	38. 2
Wyoming	1, 167		106		[4] 1, 275		36, 296	97, 914	37. 1
Total	19, 080	1, 805	21, 332	18, 838	16, 641	7, 438	1,496,774	3,022,407	49. 5
Alaska	59		433	[5] 25, 564	[6] 100, 059		299, 915	586, 400	51. 1
Hawaii							6, 435	6, 435	100. 0
Puerto Rico						[7] 811	3, 386	3, 435	98. 8

[1] Includes 15 square miles mapped on scale of 1 : 12,000.

[2] Includes 683 square miles of Great Smoky National Park in North Carolina and Tennessee.

[3] Planimetric maps covering 1,457 square miles in North Carolina, 797 square miles in North Dakota, and 1,419 square miles in Wisconsin not included in total surveys.

[4] Includes 2 square miles mapped on scale of 1 : 4800.

[5] Includes 25,131 square miles mapped on scale of 1 : 250,000.

[6] Includes 100,000 square miles mapped on scale of 1 : 500,000 with 100- to 500- foot contour intervals.

[7] Mapped on a scale of 1 : 30,000.

The mileages do not include map compilation by United States Geological Survey personnel under the supervision of the TVA.

WATER RESOURCES DIVISION

Water is the Nation's most important natural resource. It can be conserved only by using it wisely because it is transient—it cannot be stock-piled. Reservoirs continually lose water by evaporation and seepage—in some reservoirs in the West the amount of water lost may be as much as the amount of water put to beneficial use. Conservation of water therefore means wise use of water. Fortunately, water is a renewable resource. In streams and underground it is being replenished constantly through operation of the hydrologic cycle. That cycle is the circulating system whereby water in the sea and on the land is transformed to vapor in the air and then is precipitated back upon the earth, purified. The process is continuous, but because the rate varies from time to time and place to place the water supply in any one locality is always changing. Streams rise and fall; flood follows upon drought or flood in an irregular pattern; likewise the amount of water stored underground increases and decreases and the quality of the water changes as it passes over and through the rocks, dissolving minerals from them and picking up its load of sediment. Only by keeping records of these never-ending changes can we know what our water resources are. The collection and compilation of those records is the major work of the Water Resources Division.

In the United States the supply of fresh water has been so abundant that until the last hundred years it was considered essentially inexhaustible. The advance of civilization is accompanied by the steadily increasing use of water. Our modern economy is creating demands for fresh water of a magnitude and variety which formerly were never dreamed of—air conditioning is a notable example. Our population is growing steadily and the per capita use of water is increasing by leaps and bounds—for domestic purposes, for irrigating farms and pastures, for countless industries, and for the continually arising new ways of using water that are associated with high living standards and with a growing industrial capacity. An example is the tremendous quantity of water that will be required in the manufacture of synthetic fuels to supplement our dwindling oil reserves. In most of our cities the per capita daily use of water far exceeds the 100 gallons that was regarded as standard a generation ago. In our present economy there is seemingly an almost insatiable demand for water as a raw material, as a processing agent, and as a medium of heat exchange or temperature control. The full utilization of the water supply seems so close in some parts of the country that the level of social and economic development dependent upon water is already approaching a ceiling. In the arid regions there is a keen awareness of the critical place of water in determining further growth and it requires no prophet to see that the area where there is reason for concern is steadily expanding.

The amount of water lost from large reservoirs is receiving greater attention. During 1949, preliminary investigations were made to find better methods of measuring the water lost by evaporation. It is expected that the new methods, when perfected, will be used to measure the water losses of Lake Mead and other large reservoirs.

As the utilization of water supplies approaches the limit of development there is increasing need for up-to-date information on those supplies. This need is met in part by the Water Resources Review, a monthly press release by the Geological Survey giving current information about water supplies in the United States and Canada. The monthly release is supplemented by a semiannual summary of conditions, and that for the period October-to-March also contains a summary of snow surveys and status of water storage in reservoirs.

Federal Government's Interest in Water Resources

The problems of water supply and utilization affect such large areas and such wide interests that more and more they are becoming problems of national concern. Therefore the collection of information on water resources is often an obligation of the Federal Government with or without the cooperation of States and municipalities.

The Federal Government is also a large user of water-resources information. For example, in the Columbia and Missouri River Basins where great multiple-purpose dams and water development projects are being built and operated, extensive and accurate water-resources information is essential for the economic design and operation of such projects. Likewise, the need for water supplies on the public domain for watering livestock requires continuing search to maintain adequate supplies for efficient grazing operations.

The Federal Power Commission requires licensees operating hydroelectric projects to measure the flow of streams used to generate power. The Geological Survey supervised stream gaging on 132 licensed projects during 1949 at the request of the Commission.

The magnitude of the interest of the Federal Government in water-resources information during 1949 is shown by the more than $2,400,000 transferred by other agencies to provide for investigations to be made by the Geological Survey that could not be financed within its own appropriation. Those agencies include the Office of the Secretary, Bureau of Reclamation, Office of Land Utilization, Office of Indian Affairs, Fish and Wildlife Service, and National Park Service, of the Department of the Interior; Corps of Engineers, Department of the Army; Department of the Navy; Department of the Air Forces; State Department; Federal Works Agency; Tennessee Valley Authority; and Atomic Energy Commission.

Cooperation With States and Municipalities

The welfare of the Nation is dependent on agriculture and industry, and the welfare of agriculture and industry depends on adequate water supplies. The information on water supplies collected by the Geological Survey thus benefits all, and is available to all. The usefulness of this information to the people living within the area in which it is obtained is so great they have for many years supplemented Federal appropriations for this work with State and local funds. For this reason the majority of the water investigations of the Geological Survey are made in cooperation with the States and local communities. Most of these investigations must be started well in advance of a project because many years of records are necessary for the economic planning of a specific project. An adequate record once collected and compiled may be of value for many and diverse uses. On the other hand, the operation of hydraulic and industrial plants requires current information about the fluctuations in water supplies.

As the limit of the supply is approached or reached, the demand for reliable up-to-date information becomes more insistent. That the importance of this work is recognized by States and local communities is shown in the way funds offered by those agencies for cooperation with the Geological Survey have consistently exceeded the funds regularly appropriated to the Geological Survey for that purpose. The appropriation for cooperative work in 1949 was $2,457,700, including the amount in the second deficiency act. The amounts available for cooperation in fiscal year 1949 in each State, Territory, and possession are summarized below:

State:	*Total offered*
Alabama	$26,000
Arizona	82,065
Arkansas	30,940
California	144,770
Colorado	57,798
Connecticut	16,500
Delaware	3,800
Florida	76,254
Georgia	31,720
Idaho	44,864
Illinois	45,410
Indiana	58,711
Iowa	46,819
Kansas	38,519
Kentucky	23,778
Louisiana	72,020
Maine	8,996
Maryland	50,369
Massachusetts	34,956
Michigan	76,145
Minnesota	27,672
Mississippi	10,854
Missouri	23,562
Montana	25,615
Nebraska	46,939
State—Continued	*Total offered*
Nevada	$35,519
New Hampshire	11,239
New Jersey	35,553
New Mexico	75,427
New York	159,043
North Carolina	44,595
North Dakota	42,373
Ohio	79,854
Oklahoma	57,102
Oregon	49,167
Pennsylvania	142,337
Rhode Island	5,284
South Carolina	17,751
South Dakota	2,000
Tennessee	88,395
Texas	172,571
Utah	79,431
Vermont	7,260
Virginia	55,063
Washington	94,202
West Virginia	17,820
Wisconsin	28,968
Wyoming	38,591
Hawaii	67,604
Total	2,512,225

Funds aggregating more than $8,600,000 were obligated for water investigations in the fiscal year 1949. Of that amount, about 43 percent was appropriated by Congress, 29 percent was contributed by States and municipalities, and about 28 percent was provided by other Federal agencies.

Field Offices

Water investigations can be made through strategically located field offices, and in 1949 the work was conducted from more than 100 principal offices, with one or more in nearly every State and in the Territories of Alaska and Hawaii. This decentralization results in a high degree of efficiency and economy of work and in better service to the public. Close contacts are maintained with local Federal, State, and municipal officials, and the interests of cooperating agencies are served. The Survey's field offices are local sources of information as to available water resources, fluctuating stage and discharge of surface streams, fluctuations of the water table, and the chemical and physical quality of surface and ground waters.

Although the water-resources investigations are conducted along three lines—surface water, ground water, and quality of water—for administrative purposes and for reporting, the activities are so interrelated that only by giving comprehensive attention to all three can a balanced water-resource investigation be made.

Surface Water

The water flowing in surface streams varies continually from day to day, season to season, and year to year. The amount available for use can be determined only by measuring the flow over a long period of time. The task of measuring even the important streams in the Nation is a very large one which requires the collection and publication of a vast amount of statistical data. In 1949, with about 6,200 stream-gaging stations in operation, it meant the computation of more than 2 million figures of daily average stream flow. These gaging stations were operated through more than 60 field offices in cooperation with 177 agencies of States and political subdivisions and with several Federal agencies.

The stream-gaging program in Alaska, begun in 1947 with the establishment of 7 gaging stations, was expanded in 1948 and 1949 to 35 gaging stations at the end of fiscal year 1949; present plans call for the establishment of about 20 additional gaging stations in 1950. A district office at Juneau and a field office at Palmer were established during the year.

Laboratory and shop facilities were expanded for the development and improvement of equipment for the measurement of streams. A special-type snowmobile for winter observations in remote mountain areas, previously developed and constructed in cooperation with the Soil Conservation Service, Department of Agriculture, was given further field tests and some improvement was accomplished during the year.

In addition to the compilation of statistics on stream flow, many other investigations and reports on the characteristics and behavior of the flow of water in streams were made and prepared during the year. A report on the effect of backwater on discharge of rivers was prepared, based on a series of laboratory observations begun in 1947 and completed in 1948. Progress was made on a program in close cooperation with the Public Roads Administration and various State highway departments to work out better procedures and promote better utilization of stream-flow records in the solution of hydraulic and hydrologic problems connected with highway structures. Plans were made and work started on the verification of determination of discharge by slope-area and other indirect methods, a program which, it is contemplated, will be carried on for several years. A report on the Columbia River flood of May and June 1948, for which funds were allotted in June 1948, was completed during fiscal year 1949.

Ground Water

Ground water furnishes the domestic supply for more than half our population, principally on farms and in the smaller cities. It is used extensively in industrial processes because its temperature and quality remain essentially uniform the year round. It is also widely developed for irrigation and military uses. The discharge of ground water from seeps and springs maintains the dry-weather flow of streams and thus bridges the gap between rains. The water-bearing rocks that form the Nation's underground reservoirs vary widely in thickness, shape, and extent from place to place, but through modern methods of investigation they can be located and mapped accurately, and their capacity to store and yield water economically can be determined. Investigations thus far indicate that there is no over-all depletion of the Nation's ground-water resources although ground-water conditions continue critical in southern California and Arizona, the High Plains of Texas, and numerous other areas, including many in the humid East.

A new way of determining flow in steeply inclined creviced rock strata beneath a blanket of saturated glacial deposits was developed in connection with drainage problems of an iron-mining district in Michigan. A mathematical analysis was made of the way water can be made to flow from rivers to nearby wells at Louisville, Ky. A map of southwestern Louisiana was issued which shows the varying thickness of fresh-water sands and helps to outline the problem of salt-water encroachment that is threatening rice and sugar-cane irrigation. An investigation made in the vicinity of Hanford, Wash., showed the geologic and hydrologic factors that limit the disposal of waste products through infiltration basins. Geophysical studies supplemented test drilling in Champaign County, Ohio, in locating and outlining the course of a buried-valley deposit of water-bearing gravel whose position is not indicated by the surface topography, and which would have been much more costly to locate by test drilling alone. Studies showed the extent to which the safe yield of the area southwest of Los Angeles has been exceeded and the extent to which salt water is advancing inland. Studies in western North Carolina revealed the existence of important and hitherto almost untapped ground-water supplies in thin alluvial deposits along streams in the Piedmont and mountain areas. Similar conditions probably exist in comparable areas in other States.

Research is under way on the mechanics of unsaturated flow above the water table, including study of forces affecting lateral movement of water in the "capillary fringe." Also, improved equipment has been developed for determination in the laboratory of permeability of water-bearing rocks. These studies will permit more precise determination of the total quantities of water that move from one area to another.

The trend toward equitable legal control of ground water by the States is shown by the enactment in several States of new ground-water laws and the consideration of similar legislation in other States.

During the 1949 fiscal year, ground-water investigations were made on about 400 projects in the States, Hawaii, Puerto Rico, the Virgin Islands, and Alaska. The studies were made from 35 district offices in financial cooperation with 80 State, county, and municipal agencies and 9 Federal agencies. More than 200 formal reports were prepared and several thousand requests for information on ground-water conditions were answered, ranging all the way from inquiries about wells for farms to inquiries concerning the availability of 50 million gallons a day or more for industrial use.

Quality of Water

All natural waters contain mineral matter in varying amounts, depending on the types of material with which the water has been in contact. Because water is a powerful solvent, every drop of rain water carries dissolved atmospheric gases—oxygen, nitrogen, and carbon dioxide. It also carries suspended material, dust, pollen, and smoke. When rain falls, the water running over the rocks and percolating through the soil gathers more and more mineral matter in solution. The uses to which a water supply may be put depend primarily on the quantity of mineral matter dissolved or of the sediment carried by it. Not infrequently a supply may be adequate with respect to quantity but wholly undesirable or even unusable when its quality is considered. Water of unsuitable quality may cause serious losses due to corrosion, deterioration of equipment, loss of flow, boiler failure, scaling of equipment, staining and discoloration of materials, and wasting of soap. It may be unsuitable for use in processed foods, beverages, textiles, ice, bleaching, dyeing, and tanning, or may cause deterioration of recreation facilities and property values, or the destruction of fish life.

During fiscal year 1949, the chemical quality of 37,500 samples of water was determined in the central laboratory in Washington, D. C., and in the 11 field laboratories located throughout the country. These data, together with analyses made in previous years, provide a growing storehouse of factual information concerning the chemical composition of the Nation's water resources. Continuing records are invaluable in determining the changes in quality of streams and underground waters as a result of variations in climate, or the effects of agricultural development, industrial concentrations, and other activities of man. Cooperative investigations of the chemical quality of surface waters were in progress in Arkansas, Colorado, Delaware, Florida, Iowa, New Mexico, North Carolina, Ohio, Oklahoma, Pennsylvania, South Carolina, Texas, Utah, and Virginia. Samples for chemical analyses were collected daily at 143 stations on streams in connection with these programs. In addition, samples were collected on an intermittent basis at 145 stream-sampling sites. Samples were also analyzed for cooperative studies of ground water in those and other States.

Factual data concerning the adequacy of the water supply for municipal or agricultural uses or with respect to corrosiveness or scale-forming properties of the waters are essential in sound development of Federal projects and the protection of Federally owned equipment or plants. Water samples were examined and analytical results, interpretation of analyses, or advice about water problems were furnished to the following Federal agencies: Atomic Energy Commission, Bureau of Reclamation, Bureau of Mines, Fish and Wildlife Service, Department of the Navy, Veterans' Administration, Public Housing Administration, and Federal Works Agency. The Geological Survey's laboratories also regularly made analyses for the Department of the Army and the Department of the Air Force in connection with investigations of scale and corrosion problems, involving threshold treatment of water supplies at defense installations. During fiscal year 1949, 3,700 analyses were made at the request of the above-mentioned agencies, of which 470 were analyses of samples collected at defense installations in this country and at off-shore bases.

The importance of measuring the large quantities of sediment transported by the rivers of this Nation is rapidly becoming more widely recognized. The demand for the construction of large dams to impound greater quantities of water in reservoirs for irrigation, power development, and industrial use has focused attention on the probable useful life of these reservoirs. As the greater part of the sediment carried in streams is dropped in the reservoirs, it is essential that systematic studies be made to determine the quantities of sediment that will have to be taken into account in the construction of the dams and operation of the reservoirs.

During the past year the extent and scope of sediment-measurement activities of the Geological Survey increased slightly. Sediment samples were collected daily or more frequently at 127 stations on streams in the Colorado, Rio Grande, Missouri, Washita (Okla.), Schuylkill (Pa.), and Brandywine (Del.) River Basins. In addition, miscellaneous sediment samples were collected on an intermittent basis at 22 stations in these river basins. In all, more than 71,000 samples were collected and analyzed for their sediment content during the year in laboratories located at Albuquerque and Tucumcari, N. Mex.; Lincoln, Nebr.; Riverton and Worland, Wyo.; Norton, Kans.; Dickinson, N. Dak.; Stillwater, Okla.; and Schuylkill Haven and Philadelphia, Pa. Two field offices to handle intensive sediment investigations were established during the year, one at Riverton, Wyo., and the other at Tucumcari, N. Mex.

Missouri River Basin

The coordinated projects of the Bureau of Reclamation and the Corps of Engineers, Department of the Army, for the development of the Missouri River Basin require extensive water investigations in that basin. The investigational programs, conducted generally in cooperation with States and municipalities, were supplemented by 200 stream-gaging stations operated in the Departmental program; by studies related to ground-water supplies or to changes in ground-water conditions that may result from reservoir construction or irrigation in the vicinity of 33 reclamation units; by 31,000 measurements of the sediment content of surface waters at 70 regular stations and 21 stations for miscellaneous measurements; by 6,918 analyses of the chemical quality of the waters at 16 regular stations and at 79 stations for miscellaneous records; by 320 chemical analyses of ground waters from various sources; and by hydrologic and utilization studies related to the proposed plans of development. The information obtained through these investigations is furnished to the above agencies currently or periodically as desired.

Interstate Compacts

Interstate compacts, for division between States of waters of interstate streams, which authorize or require the establishment and operation of gaging stations, generally by the Geological Survey, are now in effect for Colorado River (Wyoming, Utah, Colorado, New Mexico, Arizona, Nevada, California), Belle Fourche River (Wyoming, South Dakota), Republican River (Nebraska, Kansas), Rio Grande (Colorado, New Mexico, Texas), Costilla Creek (Colorado, New Mexico), Cheyenne River (South Dakota, Wyoming), Pecos River (New Mexico, Texas), and Arkansas River (Colorado, Kansas). Similar compacts are in process of negotiation for Yellowstone River (Montana, North Dakota, Wyoming), and Bear River (Idaho, Utah).

International Treaties

International problems related to water are increasing. The Geological Survey, using funds transferred by the State Department, makes the water resources investigations along the Canadian boundary that are required by orders issued by the International Joint Commission, United States and Canada, under the treaty of January 11, 1909. In addition to these continuing investigations needed for division and control of waters along the international boundary, several special investigations were made in 1949 in connection with references before the Commission, particularly those relating to the Columbia River Basin, Sage Creek, Mont., Waterton and Belly Rivers, and Souris and Red Rivers. The Geological Survey, through agreement with the State Department, has continuing obligations for obtaining water resources information along the Mexican boundary as required by the Mexican Water Treaty of 1944. Members of the Geological Survey serve on several international engineering boards.

Reports on Investigations

The results of the varied studies and computations made by the Water Resources Division are made available for public inspection as soon as practicable by placing manuscript copies of observations, measurements, and analyses in the open files of the district offices concerned. The availability of this information is announced through press releases. Stream-flow and ground-water conditions in the United States and Canada are summarized monthly and semiannually in the Water Resources Review.

The published work of the Water Resources Division during the fiscal year 1949 consisted of 21 new water-supply papers and 1 reprint, a large number of shorter reports in the technical press, and 85 reports transmitted to cooperating State agencies for publication by them. In addition, a number of miscellaneous processed reports were issued.

CONSERVATION DIVISION

Under delegation of authority from the Director, the Conservation Division classifies the public lands of the United States as to mineral and water resources, and under a delegation from the Secretary of the Interior it supervises mineral recovery operations under leases, permits, and licenses on public, acquired, Indian, and naval petroleum-reserve lands. The Division maintains a small headquarters staff in Washington and a field staff of competent geologists and engineers in strategic centers of mineral-resource development. This investigative, supervisory, and regulatory force makes field surveys, prepares maps and reports dealing with water power, fuels, minerals, and chemicals essential to the mineral-resource economy of the United States, and conducts on-site supervision of mining and drilling methods essential to the economical and safe production of coal, oil, gas, and other minerals, all to the end that this Nation's mineral resources shall be developed and produced by private enterprise in accordance with approved methods and in compliance with accepted conservation practices under applicable Federal legislation.

Mineral Classification

In response to the continuing demand for increased supplies of mineral fuels, fertilizer ingredients and basic chemicals from lands and deposits owned by the United States and for other types of public land for agricultural, grazing, or residential use, all phases of the service rendered by the Mineral Classification Branch in the administration of Federal lands were maintained at an active pace throughout the fiscal year 1949.

In all some 24,972 cases involving either the outright disposal of Federal lands with no reservation of any mineral, the disposal of such lands with the reservation of one or more specified minerals to the United States, or the exercise under the Federal leasing laws of the Government's right to explore for and produce one or another mineral substance from lands under its jurisdiction, were acted upon during the year. This represents a decrease of about 14 percent in mineral reports rendered in 1949, compared with 1948, due chiefly to the slump in demand therefor during the regionalization of the Bureau of Land Management in the early part of the fiscal year. In addition the branch prepared and promulgated initial or revised definitions of the known geologic structure of 16 producing oil or gas fields containing Federal land; appraised geologically 110-unit plan or participating-area submissions; drafted 348 determinations of leasehold relations to the productive limits of oil and gas deposits as found to exist on August 8, 1946, pursuant to sections 4 and 12 of the act approved on that date (60 Stat. 950); and reported for appropriate administrative action the fact and geologic significance of 56 new discoveries of oil or gas on or affecting Federal lands.

From field offices in Colorado, Wyoming, Montana, Utah, California, New Mexico, and Oklahoma, respectively, branch geologists made numerous "spot" investigations precedent to public-land and mineral-leasing law administration, which resulted in sundry reports and maps for official use in the Department of the Interior, the Department of Justice, and the National Military Establishment and in published maps of the areal and structural geology of the Lothair area, Liberty County, Mont., and of the Mush Creek and Osage oil fields and vicinity, Weston County, Wyo. One branch geologist remained on detail the entire year to the Department of Justice in connection with proceedings in the case of the *Confederated Bands of Ute Indians* v. *the United States*, No. 45585 in the United States Court of Claims.

Water and Power Classification

The field work of the Water and Power Branch during 1949 was performed principally for the purpose of obtaining basic information concerning the water-power resources and storage possibilities of Federal lands on which projects were proposed for early development. Work was expanded in Alaska and was continued in the Missouri River Basin to meet the immediate needs of the Bureau of Reclamation and the Corps of Engineers, United States Army, for maps to use in planning future projects.

Topographic surveys were made of 4 dam sites (Power Creek and Eagle River, Alaska, Nooksack River, Wash., and Trinity River, Calif.), 29 square miles of reservoir site (Moorehead, in Wyoming and Montana) and 113 miles of river channel of which 43 miles are in the Missouri River Basin. In cooperation with the Water Resources Division, supervision of construction and operation was given to 160 power projects under license with the Federal Power Commission, to 271 such projects under permit or grant from the Department of the Interior, and to 178 in cooperation with the Bureau of Indian Affairs.

Classification activities resulted in the addition of 58,052 acres to power-site reserves and elimination of 10,671 acres, increasing the outstanding reserves in 23 States and Alaska to a net total of 6,816,378 acres. Maps published covered 425 miles of stream channel of 9 rivers, and 8 dam sites aggregating 71 square miles. Final action involving hydraulic determination was taken on 312 cases received from departmental sources and the Federal Power Commission, and on 4,208 cases that also involved mineral classification. Investigation and studies were in progress involving the power and water-storage possibilities of 45 rivers and lakes. Six reports on power possibilities of certain streams were completed and made available for public inspection. Reservoir site reserves in 9 States remain unchanged at 137,172 acres.

Mining

The Mining Branch is responsible for the supervision of operations for the discovery and production of coal, potassium, sodium, phosphate, oil shale, sulfur, and silica sand on public domain lands; of gold, silver, and mercury on certain land grants; of quartz and vanadium under departmental authorizations; and of all minerals, except oil and gas, on segregated, restricted, allotted, and tribal Indian lands, and acquired lands transferred to the Department of the Interior from the Department of Agriculture under section 402 of the President's Reorganization Plan No. III of 1946.

In addition to the aforementioned minerals, the operations involved the supervision of production of copper, manganese, uranium, asbestos, limestone, gravel, sand, marble, silica, iron, gypsum, vermiculite, pumice, clay, fluorspar, feldspar, lead, zinc, barite, mica, tungsten, and garnet. Sodium production included salt, borax, salt cake, soda ash, and associated lithium and bromine.

As of June 30, 1949, there were under supervision 1,050 properties under lease, license, permit, or secretarial authorization. Of these, 731 were on public domain, 86 were on acquired land, 230 were on Indian land, and 3 were secretarial authorizations. These involved lands in 12 Eastern States, 16 Western States, and Alaska. The work was directed from seven field offices in the States and one in Alaska.

Production supervised during the fiscal year is estimated at 15,403,685 tons valued at $98,018,882, with accrued royalties of $2,976,751, indicating an approximate increase over the preceding year of 521,185 tons in production, in excess of $12,000,000 in value, and $180,000 in royalties. Total income, including royalties, rentals, and bonuses, is estimated at $3,132,726.

The branch is charged with the responsibility of recommending lease terms, enforcing regulations governing the conduct of prospecting and mining operations relating to the safety and welfare of employees, protecting the natural resources, preventing waste, determining royalty liability of lessees, and obtaining compliance with lease terms and adherence to approved mine-development plans.

The scope of the responsibilities of the Mining branch was broadened during the year by the transfer from the Bureau of Land Management of the function of preparing statements and receiving collections for rentals and royalties due the United States on production from federally owned land.

Production of coal from public land in the United States and Alaska, not including production from land in Oklahoma, approximated 8,025,000 tons, compared with a production of 7,405,760 tons during the previous fiscal year.

Potassium production continued to increase and established a new record of more than 1,100,000 tons of K_2O equivalent. For the second year, it exceeded in value the coal produced from public land.

Prospecting operations for potash in New Mexico during the year disclosed additional valuable deposits. The number of permits in effect as of June 30, 1949, was 177 as compared to 56 on June 30, 1948. In addition to the three producing companies in New Mexico and the Duval Texas Sulphur Co. which began prospecting operations in December 1947, three new corporations began prospecting land in the vicinity of the developed areas in New Mexico, namely, the Southwest Potash Co., the Central Farmers Fertilizer Cooperative, and the Freeport Sulphur Co. Prospecting and experimental solution mining by the Continental Potash Co. in section 22, T. 20 S., R. 29 E., were discontinued because of difficulties of operation and failure to discover a deposit sufficiently valuable for development by that process.

Production of phosphate from public and Indian land of 379,786 tons represented a decrease of 36.5 percent from the preceding year. The completion of the Army contract for Idaho phosphate shale for shipment to Japan in the early part of 1948 and the lack of immediate market for the shale accounts for the decrease.

The brine of Searles Lake, in California, under potassium leases was also a principal source of sodium compounds. Refined salts from that source contain potassium, borax, soda ash, salt cake, bromine, burkite, and sodium lithium phosphate. The Ozark-Mahoning Mining Co. prospected intensively for sodium sulfate in the Carlsbad, N. Mex., area, and prospecting for sodium, particularly sulfate, continued in widely scattered areas in California, Nevada, North Dakota, and Oregon.

Lead and zinc concentrate production from Quapaw Indian land in Oklahoma amounted to 40,865 tons as compared to 42,490 tons for 1948 fiscal year. A drop in zinc and lead prices from $110 to $55 a ton and $292.17 to $148.63, respectively, resulted in the closure of marginal mine operations on Quapaw Indian land in Oklahoma. Increase in prices or subsidies is the hope of many companies for continuance of operations.

Fluorspar (calcium fluoride), essential to steel production, was the principal product from acquired land in Illinois that is also valuable for lead and zinc. Other minerals from acquired land include coal, silica, feldspar, mica, and asbestos. Prospect operations for barite continued in Arkansas and Missouri. Barite is in great demand for use as heavy mud in deep-well drilling for oil and is potentially one of the most important products from acquired land.

The effectiveness of the supervision is reflected by the character of the operations and by the cooperation attained from management and employees in the enforcement of safety regulations. This is attested by the awards by the Joseph A. Holmes Association to 5 Government lease operations out of a total of 64 to the entire bituminous coal industry in the United States. One lessee received the bronze Sentinels of Safety trophy and the Sentinels of Safety flag for top honors in national safety competition among bituminous coal mines.

Oil and Gas Leasing

The Oil and Gas Leasing Branch supervises drilling operations for the discovery and production of petroleum, natural gas, and liquid petroleum reserves on acquired lands transferred from the Department of Agriculture to the Department of the Interior under section 402 of the President's Reorganization Plan No. III of 1946, and on all Indian lands subject to departmental jurisdiction, both tribal and allotted, except those of the Osage Nation in Oklahoma. During the year these duties were accomplished through 22 field offices and suboffices in California, Colorado, Montana, New Mexico, Oklahoma, Utah, and Wyoming. The scope of the responsibilities of the branch were increased during the year by the transfer from the Bureau of Land Management of the function of preparing bills and receiving collections for rentals and royalties due the United States on production from Federal lands.

On the public lands 21,274 oil and gas properties were under supervision at the end of the fiscal year, aggregating 19,011,843 acres in 22 States and Alaska, an increase of 58 percent in the number of properties and 77 percent in the acreage under supervision at the close of the previous fiscal year.

Drilling on public lands during the year included the spudding of 795 wells and the completion of 895 wells, of which 633 were productive of oil and gas and 258 were barren. In all 14,205 wells, including 7,948 capable of oil and gas production, were under supervision on June 30, 1949. The production from petroleum deposits of the public lands during 1949 was substantially greater than during 1948. Production from public lands during the year amounted to about

77,000,000 barrels of petroleum, 130,000,000,000 cubic feet of natural gas, and 157,000,000 gallons of gasoline and butane, rendering royalty returns of approximately $25,000,000 to the United States.

Drilling on acquired lands during the year included the spudding of 72 wells and the completion of 68 wells, 42 of which were productive of oil or gas and 26 of which were barren. In all 152 acquired land wells, including 104 capable of oil or gas production, were under supervision on June 30, 1949. The production from acquired lands during the fiscal year amounted to about 720,000 barrels of petroleum, 351,000,000 cubic feet of natural gas, and 2,200,000 gallons of gasoline and butane, rendering royalty returns of approximately $190,000.

On Indian lands the work of oil and gas lease supervision involved 6,394 leaseholds in 12 States, containing at the end of the year a total of 8,088 wells, 4,089 of which were productive of oil or gas and 282 of which had been completed during the year. Total revenue from such operations as royalties, rentals, and bonuses, amounted to $7,830,000.

On behalf of the Department of the Navy, supervision was continued in 1949 over operations for the production of oil, gas, gasoline, and butane from 21 properties under lease in Naval Petroleum Reserve No. 2 in California. Production from 272 active wells on Reserve No. 2 aggregated 2,657,000 barrels of petroleum, 2,086,000,000 cubic feet of natural gas, and 7,180,000 gallons of natural gasoline and butane, having an aggregate royalty value of $982,270.

On Department of the Army lands in the Rio Vista field the work included the consideration and approval of a number of the revisions in participating percentages for these lands and the computations of royalties due the United States on the gas production allocated to the lands in the amount of 4,115,852,000 cubic feet with a royalty value of $331,300.

Activities toward unitization of oil and gas operations involving Federal land were reflected in the approval of 54 new unit plans during the year and the termination of 24 previously approved unit plans, leaving 194 approved plans, covering 2,923,002 acres, outstanding on June 30, 1949. About 50.8 percent of the petroleum obtained from public lands during the year was produced under approved unit agreements. In addition one Indian-land unit agreement covering 3,700 acres was approved during the year, leaving 4 such approved units covering 15,448 acres outstanding on June 30, 1949. There were also 28 drilling agreements approved during the year, making a total of 76 approved as of June 30, 1949; these agreements involving isolated small tracts which are communitized to form a logical drilling unit and, in effect, constitute an agreement similar to a unit agreement, though involving only a small segment of a single field or pool.

WORK ON PUBLICATIONS

Texts

During the year 133 new manuscripts were received by the Section of Texts, 144 manuscripts were sent to the printer, and 120 publications were delivered by the printer. Work on these included 10,586 pages of manuscript edited and prepared for printing; 1,516 galley proofs and 2,775 page proofs revised and returned; indexes prepared for 21 publications, covering 1,339 pages and consisting of 4,229 entries. Copy edited in preparation for mimeographing included 50 press releases, consisting of 85 pages and 93 pages of miscellaneous material.

Reports delivered were as follows: Professional Papers 199–B, 213, 214–B, 214–C, and 215; Bulletins 944–C, 954–B, 954–C, 954–D, 954–E, 954–F, 956, 958, 959–B, 959–C, 959–D, 960–A, 960–B, 960–C, 960–D, 960–E, and 966–A; volume contents for Bulletins 940 and 945; Water-Supply Papers 995, 1023, 1024, 1025, 1026, 1027, 1033, 1035, 1042, 1045, 1052, 1054, 1057, 1058, 1059, 1060, 1061, 1062, 1063, 1064, 1077, and 1080; and Circulars 19, 20, 21, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 35, 36, 37, 39, 41, 42, 44, 45, 46, 48, 57, and 58. These cover a wide range of subject matter—general geology of particular areas; mining districts and local mineral deposits in the United States, Brazil, Mexico, Chile, Cuba, and Haiti; studies of fossils and the rocks in which they are found; geophysical abstracts, a quarterly serial; measurements of stream-flow and of water level and artesian pressure in wells; general studies of underground water and of the occurrence of floods, with consideration of the influence of geology and physiography.

In order to keep the public informed 12 lists of new publications were issued. Also printed during the year were 34 State index circulars; 25 pamphlets to accompany index circulars; 2 new geologic map series, Pawtucket quadrangle, bedrock and surficial geology; and general information on maps and folios of the Geological Survey.

Illustrations

Of a total of 44 reports on hand at the beginning of the fiscal year, 18 were in various stages of completion. Twenty-four reports were received and 28 were completed and transmitted, leaving a total of 40 reports on hand, 19 of which were in various stages of completion. Those transmitted included 7 professional papers, 14 bulletins, and 7 water-supply papers, which consisted of 1,277 completed drawings and photographs. In addition 308 miscellaneous pieces of drafting were completed.

The move to new quarters, with additional space and improved lighting facilities, and the procurement of new equipment has increased the efficiency of the work.

MAP REPRODUCTION

During the year 21 newly engraved topographic maps were printed. Five hundred thirty-six multicolor topographic maps, 41 river survey maps, 19 planimetric maps, 5 geologic index maps, 36 topographic index maps, 80 geologic preliminary maps, and 28 special maps were printed, making a total of 764 new maps printed and delivered. Reprint editions of 452 engraved topographic maps, 24 multicolor maps, and 16 photolithographed State geologic, planimetric, preliminary, and other maps were printed and delivered. Of new and reprinted maps, 1,258 different editions, amounting to 3,263,184 copies were delivered.

A large amount of work was done for 48 other units of the Government, including Geological Survey branches, and States, and the charges for it amounted to about $153,440 for which the appropriation for engraving and printing geologic and topographic maps was reimbursed.

Transfer impressions and velox and plate prints numbering 163 were made during the year.

Of topographic maps and contract and miscellaneous work of all kinds, a grand total of 3,493,777 copies were printed and delivered.

The photographic laboratory made 8,870 negatives, 31,192 prints, 4,042 photolith press plates, mounted 352 prints, developed 43 film packs, 218 rolls of film, and developed and printed 51,600 feet of aerial film.

Distribution

During the year the Branch of Distribution received a total of 1,310 publications, comprising 75 new book reports and pamphlets and 5 reprints; 30 preliminary maps and charts in the oil and gas, strategic minerals, and geophysical investigations series; 651 new or revised topographic and other maps (11 of which were first published as preliminary editions); 8 Tennessee Valley Authority maps with contours, and 541 reprinted maps.

The total units received numbered 110,774 books and pamphlets (including reprints), 107,000 copies of revised index maps, and 3,131,302 topographic and other maps, a grand total of 3,349,072.

The branch distributed 83,041 books and pamphlets, 1,787 geologic folios, and 1,303,979 maps, a grand total of 1,388,807 of which 1,267 folios and 839,882 maps were sold.

The net proceeds from sales were $139,855.79 for maps and $553.35 for geologic folios. In addition, $21,421.04 was repaid by other Government agencies for maps or folios furnished. The total net receipts, therefore, were $161,830.18. Local sale of maps to private individuals was $5,888.75. The branch handled nearly 70,000 letters.

	On hand July 1, 1948	Received	Distributed	On hand June 30, 1949
Geologic folios	15, 907	----------	1, 787	14, 120
Maps	15, 956, 940	3, 238, 302	1, 303, 979	17, 891, 263
Publications:				
Complete volumes	110, 717	71, 330	54, 329	127, 718
Separate chapters, extracts, and miscellaneous pamphlets	166, 981	39, 444	28, 712	177, 713
Total	16, 250, 545	3, 349, 076	1, 388, 807	18, 210, 814

FIELD EQUIPMENT

On the transfer of the division from the Topographic Division to the executive officer in December, the unit was divided into the Property Control Section, which has custody of all Geological Survey equipment, and the Property Maintenance Section, consisting of the instrument and woodworking shops in Washington.

Development is under way for the keeping of records involving over 50,000 items of numbered equipment in the Property Control Section to be accomplished, so far as practical, by a machine records system. The Denver shop has now relieved the Washington shop of about half of the Survey's equipment maintenance work, which has permitted the construction of more special instruments in the Washington shop than for several years. Working space continues to be a major problem in the proper functioning of both sections.

In spite of the transfer during the past 2 years of several instrument makers from Washington to other Survey shops, qualified replacements have been obtained, and the Washington shop now employs as many high-caliber instrument men as space will permit.

With the present normal backlog of repair work it is planned that a larger portion of the instrument shop's capacity will now be used in cooperation with the Survey's engineering personnel for the development and construction of urgently needed new equipment. Serious consideration is being given to the organization of a research and development unit to expedite and to perform more efficiently the necessary engineering work involved.

A wide-angle Kelsh plotter has been developed and contracts let for the purchase of 12 units. Because of the scope and potentialities of this project, some phases of this research will extend over a period of years.

FUNDS

During the fiscal year 1949 obligations were incurred under the direction of the Geological Survey totaling $26,711,906. Of this amount $13,163,889 was appropriated directly to the Geological Survey, and $13,548,017 was made available by other Federal agencies and by states and their political subdivisions.

Obligations incurred by the Geological Survey in fiscal year 1949 (by source of funds)

Topographic surveys and mapping:	
Geological Survey appropriation	$4, 931, 912
States, counties, and municipalities	850, 499
Office of the Secretary	2, 400
Bureau of Reclamation	2, 447, 820
Department of Commerce:	
Bureau of Public Roads	48, 222
Department of Defense:	
Department of the Air Force	510, 363
Department of the Army	59, 607
Department of the Navy	62, 855
Sale to the public of aerial photographs and photographic copies of records	17, 590
Miscellaneous	391, 363
Total	9, 322, 631
Geologic and mineral resource surveys and mapping:	
Geological Survey appropriation	3, 144, 818
States, counties, and municipalities	123, 118
Office of the Secretary	1, 800
Bureau of Reclamation	363, 207
National Park Service	10, 960
Department of Defense:	
Department of the Army	649, 218
Department of the Navy	235, 545
Department of State	142, 013
Atomic Energy Commission	2, 553, 710
Economic Cooperation Administration	9, 045
Miscellaneous	9, 256
Total	7, 242, 690
Water resources investigations:	
Geological Survey appropriation	3, 721, 318
States, counties, and municipalities	2, 512, 225
Office of the Secretary	176, 149
Bureau of Reclamation	1, 079, 184
Bureau of Indian Affairs	40, 550
Office of Land Utilization	41, 304
Fish and Wildlife Service	6, 373

Obligations incurred by the Geological Survey in fiscal year 1949 (by source of funds)—Continued

Water resources investigations—Continued	
Department of Defense:	
Department of the Air Force	$6,750
Department of the Army	815,190
Department of the Navy	7,743
Department of State	100,839
Atomic Energy Commission	47,801
Tennessee Valley Authority	77,188
Permittees and licensees of Federal Power Commission	42,687
Miscellaneous	42,697
Total	8,688,202
Classification of lands:	
Geological Survey appropriation	292,559
Office of the Secretary	400
Bureau of Reclamation	41,181
Miscellaneous	11,072
Total	345,212
Supervision of mining and oil and gas leases:	
Geological Survey appropriation	723,847
Office of the Secretary	1,000
Department of Defense:	
Department of the Navy	22,858
Miscellaneous	564
Total	748,269
General administration:	
Geological Survey appropriation	349,435
Office of the Secretary	15,067
Total	364,902
Total funds available	26,711,906

Oil and Gas Division

Robert E. Friedman, *Acting Director*[1]

SINCE the establishment of the Oil and Gas Division by the Secretary of the Interior on May 6, 1946, pursuant to the President's instructions in a letter dated May 3, 1946, the Division has been continuously concerned with urgent problems of national significance.

As the primary civilian agency for petroleum planning, the Division, working with a petroleum industry committee of 34 members appointed by the Secretary of the Interior, formulated the Voluntary Plan for the Allocation of Petroleum Products under Public Law 395, Eightieth Congress. By Executive Order No. 9919, of January 3, 1948, the President delegated to the Secretary of the Interior full authority to enter into such voluntary agreements with industry with respect to fuels, including petroleum and petroleum products and natural and manufactured gas. The plan was designed to promote the orderly and equitable distribution of petroleum products, to prevent or alleviate consumer hardship resulting from insufficiency or disruption in the supply of petroleum products, to aid in the stabilization of the economy of the United States, and to curb inflationary tendencies. After consultation with industry, labor, and the public, the plan was approved by the Attorney General and became effective with the approval of the Secretary of the Interior on August 10, 1948. In general, and with certain exceptions, the plan followed the Temporary Allocation Agreement under the same act, described in last year's annual report, that proved so valuable during the shortage of petroleum products in the winter of 1947–48 and spring of 1948.

By the time the new plan was adopted, the petroleum supply outlook had improved and no shortages of petroleum products were forecast for the remainder of the year. In September, however, labor difficulties in six of the seven major refineries on the west coast created shortages of petroleum products, particularly motor gasoline, necessitating voluntary action under the plan for a period of several weeks. Regional committees and subcommittees under the plan began functioning promptly. In addition, the Division asked the Governors of Arizona, California, Nevada, Oregon, and Washington to appoint fuel coordinators. Through the cooperative efforts of the regional committees, subcommittees, and the fuel coordinators, no serious consumer hardships resulted.

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[1] Max W. Ball was Director of the Oil and Gas Division during the first half of the fiscal year; Robert E. Friedman served as Acting Director for the remainder of the fiscal year.

The Division's value in coordinating and unifying Federal oil and gas policy and administration is evidenced by the daily advice and assistance it gives to other agencies and to the Congress. During the year, the Division provided assistance to the Department of State, Department of Justice, Central Intelligence Agency, Economic Cooperation Administration, Federal Mediation and Conciliation Service, Federal Power Commission, Federal Communications Commission, Atomic Energy Commission, Interstate Commerce Commission, Office of Defense Transportation, Maritime Commission, Armed Services Petroleum Purchasing Agency, Armed Services Petroleum Board, Office of Naval Petroleum Reserves, Navy's Bureau of Yards and Docks, Bureau of Internal Revenue, and many other Federal bureaus and offices, on matters affecting the petroleum supply.

Further, the Division advised, assisted, and supported the Department of Commerce in the development of four of its voluntary plans for the allocation of steel under Public Law 395. Being ever mindful of the petroleum industry's needs for steel, the Division urged the Department of Commerce to enter into voluntary agreements with the steel industry to provide enough steel for all essential requirements of the petroleum and allied industries.

The Division also worked with the Department of Commerce on matters of export policy and export controls for petroleum and for equipment required by the petroleum industry for operations abroad.

The National Security Resources Board and the National Military Establishment asked the Division for assistance on numerous petroleum matters affecting the military, national security, and defense. There was continual liaison and representation on committees and working groups making studies and formulating programs and recommendations on petroleum-mobilization planning in the event of emergency.

The Division represented the Department in all matters concerning disposal of Government-owned synthetic rubber facilities and served on various interagency committees created to make policy and legislative recommendations with respect to synthetic rubber.

The development of additional oil possibilities in the Western Hemisphere is important to the defense of the Hemisphere and of the United States, as well as to the American oil industry. Renewal of interest by American companies in new possibilities in South America brought into focus the lack of suitable maps for use in detailed geologic and geophysical work in most South American countries. To overcome this deficiency the Division arranged for the release of trimetrogon air photos and base compilation data secured by the Air

Force during the war period. Negotiations over a period of six months resulted in the establishment of a service, under which American companies have access to the data and can prepare therefrom their own maps to meet their own special requirements.

To aid in the unification and coordination of administrative action and policy on oil and gas matters, the Division's Washington executive technical staff, which at no time in the fiscal year exceeded 7 members, participated in 327 meetings and conferences with representatives of other Federal agencies. To further public understanding of congressional and administrative policy on oil and gas matters, members of the staff appeared personally and made statements or addresses before many congressional committees, trade associations, and meetings of groups of industry representatives. The Division's Associate Director represented the Department as a member and adviser of the delegates of the United States to the second session of the Petroleum Committee of the International Labor Organization, at Geneva, Switzerland, in November. The Division was included in the Department's representation at the International Geological Congress, in London, England, held during August and September.

The Interdepartmental Petroleum Committee was created by the Secretary of the Interior on July 8, 1946, to assist in the coordination and unification of administrative policy and activities with respect to oil and gas. Under the chairmanship of the Division, the Committee, convening semimonthly, functioned effectively and was exceedingly active. Agenda items covered a wide variety of problems. Those of particular importance were: Employment and registry of tanker vessels, the Economic Cooperation Administration petroleum program, dollar-sterling problems, the so-called "tidelands" situation, ways and means of securing better statistics on world-wide petroleum operations, export controls, the changing steel situation as it affected availability of petroleum-industry equipment and supplies, the new oil-field developments in Canada, and the changing petroleum supply and demand situation. Regular discussion of these and other matters of mutual interest served to correlate the thinking and unify the policy positions of the agencies represented.

In discharging its responsibility to serve as the Federal Government's channel of communication and liaison with the petroleum industry, the Division maintains close contact with the industry, chiefly through the National Petroleum Council which was created in June 1946, by the Secretary of the Interior. As in previous years, the Council made many invaluable contributions of information and counsel, at no expense to the Government. The Council, which is composed of 90 members representing every geographic and functional division of the petroleum industry, met quarterly during the year. In responding to the Federal agencies' requests for advice and information on matters which were submitted to it by, or approved by, the Secretary of the Interior or the Director of the Oil and Gas Division, it was necessary for the Council to create 34 committees and subcommittees on which 467 industry representatives were asked to serve. The committees prepared 27 formal reports on matters of vital concern which included: A national oil policy for the United States, procedures and policies for Government-Industry cooperation in event of a national emergency, oil and gas industries' needs for steel, Government royalty oil regulations, military and Government petroleum requirements, petroleum production and crude availability, refining capacity, storage capacity, petroleum-industry census, and others. In addition, to activate and to implement the voluntary plan for the allocation of petroleum products under Public Law 395, the Council created five regional advisory committees and numerous subcommittees. The work of these committees demonstrated the effectiveness of the plan during the period of shortage of motor gasoline when refineries on the West Coast were closed because of labor difficulties. Further, the Council's Committee on Military and Government Petroleum Requirements maintained continual liaison with the military and the Federal Bureau of Supply with the result that military and Government petroleum requirements were met when and where needed. The Council also assisted the Treasury Department in sponsoring an industry-wide drive to further the Government's bond savings program. At the close of the fiscal year, a Council committee was progressing with plans for a complete survey of all the manpower employed in the petroleum industry, which will serve as a basis for the National Security Resources Board's petroleum mobilization planning in event of an emergency.

The Military Petroleum Advisory Committee was created by the Secretary of the Interior on March 29, 1947, to provide expert counsel, advice, and information on oil and gas matters relating to confidential military planning for petroleum national security and defense. The charter was amended on October 7, 1948, to expand its usefulness to the Government and its name was changed to Military Petroleum Advisory Board. The Board was enlarged from 17 to 20 members. At the beginning of the fiscal year, pending before the Board were 9 major defense problems; reports were submitted on 7, and most of these require continuous study to keep them current. In addition, the Board received and worked on 10 new problems which were presented to it by the military. In complying with requests from the National Military Establishment, the Board called upon 181 experts in the petroleum and allied industries to serve, without cost to the Government, on panels, committees, and subcommittees, created to provide expert data and opinion on matters before the Board.

In serving as liaison agency of the Federal Government with State oil and gas bodies, the Division has nonvoting membership on the Interstate Oil Compact Commission and was represented at its quarterly meetings. The Division also participated in the Compact's Economic Advisory Committee deliberations and in the activities carried on by its Secondary Recovery Advisory Committee. Liaison was maintained directly with State conservation and regulatory bodies by the members and examiners of the Federal Petroleum Board and by the Division's relations with emergency fuel coordinators appointed by the Governors of some of the States and by direct contacts with State officials.

The Connally "Hot Oil" Act (15 U. S. C. 715–7151), which prohibits interstate shipment of oil produced or handled in violation of State laws, is administered under supervision of the Division by the Federal Petroleum Board with headquarters at Kilgore, Tex. The Board consists of a chairman and member located at Kilgore and an alternate member in charge of the suboffice at Midland, Tex. Suboffices are also located at Houston, Tex., and at Lafayette, La. In addition to the Board members, all of whom are active in the field, the staff consists of 24 individuals, 14 of whom are field examiners, and the remaining 10 of whom comprise accountants, administrative, stenographic, and clerical personnel.

While the act is applicable wherever State laws limit the rate of production and prescribe conditions for producing and handling oil, its chief application occurs in the States of Texas, Louisiana, and New Mexico where regulations prescribed under the act are actively enforced by the Board and its staff. To a lesser degree, enforcement activities are carried on in the States of Oklahoma, Arkansas, Kansas, and Mississippi.

The principal functions of the Federal Petroleum Board are those of preventing, so far as possible, violations of the act and the application of its sanctions to the more important of the violations that do occur, achieved primarily through continuous field investigations by the examining staff, observing and inspecting producing, transporting, storing, and processing operations and the inspection and auditing of prescribed records and reports.

From an area designated by published regulation which includes 102 counties in Texas, 2 in New Mexico,, and the entire State of Louisiana, the Board receives and processes each month about 4,50 monthly reports distributed approximately as follows: From producers, 3,930; from transporters, 483; from processors, 77. These reports cover operations in more than 593 separate oil fields, aggregating some 52,824 producing oil wells, the total average monthly crude-oil production from which is approximately 59,679,991 barrels. This represents approximately 38 percent of the total crude oil produced monthly in the United States.

The enforcement activities during the fiscal year by the Board's staff included the following: (1) the "visiting" of 2,847 leases; (2) making 1,690 "lease inspections," of which 715 leases were fully gauged and checked over continuous periods, and (3) the "physical inspection and checking" of 45 pipe lines, pump stations, and refineries. In carrying on this work it was necessary that 1,029 persons be interviewed and interrogated during routine field investigations. In addition, 444 persons were interviewed, and 32 hearings were held in connection with follow-up investigations to determine whether violations of the act had occurred. In connection with the above, 458 separate fields were checked and inspected.

There were pending on the Board's docket at the beginning of the fiscal year 12 Connally Act cases. Of these, 9 were pending investigation, 2 awaiting administrative disposition by the Board, and 1 was pending in the United States District Court. Of these 12 cases, at the close of the year, only 1 was pending administrative action by the Board, 1 case was closed by administrative action of the Board, and 1 by action of the Department of Justice.

Investigation was completed during the year on nine of the cases that were pending at the beginning of the year. Seven of these completed investigative case reports were referred to the United States Department of Justice for prosecution. During the year, 12 case investigations were initiated and 3 cases were closed by successful prosecutive action, resulting in fines being imposed and paid in the aggregate amount of $8,500.

At the close of the year, there were pending with the Department of Justice six cases awaiting prosecution; three were pending in the district courts of Louisiana. Ten cases were pending administrative action of the Board, aggregating 19 cases pending at the close of the year. One of the cases pending in Louisiana has been awaiting trial since 1939; two others in which charges were filed in April and May 1949, were awaiting the disposition by the court of various dilatory motions.

In keeping with its established policy, all activities of the Board were carried on in close cooperation with other public authorities, both State and Federal, having related functions, particularly the Railroad Commission of Texas and the Conservation Commission of the State of Louisiana, as well as United States attorneys, the several attorneys general, and taxing authorities having interests touching the subject matter dealt with by the Board.

Office of Land Utilization

Lee Mack, *Assistant to the Secretary*

DURING the fiscal year 1949, the Office of Land Utilization began its tenth year as the coordinating agency for the land and renewable resource management programs of the Department of the Interior. In this first decade of its operations, the Office has firmly established, in the Department, the soil and moisture program under the Soil Conservation Act of 1935 and Reorganization Plan No. IV of 1940; the white pine blister rust control program under the act of April 26, 1940; and the forest pest control program under the act of June 25, 1947. It has formulated procedures for handling the technical aspects of appeals to the Secretary from adverse decisions of the Bureau of Land Management concerning applications for purchase, entry, or lease of public lands. It has coordinated and strengthened the management of the forest lands administered by the various bureaus and offices, particularly with respect to fire protection, timber sale activities, and sustained yield. Major forward steps have also been taken by the Office looking to a more effective coordination of the water resource development programs of the Department and a clearer understanding of the many complicated problems involved in this field. A detailed discussion of the activities during the fiscal year 1949 follows:

SOIL AND MOISTURE CONSERVATION

A large part of the past destruction and waste that has accompanie the use of our natural resources can be charged to the lack of knowledg as to how best to manage and use them. That excuse is no longe tenable. With the passage of time a large reserve of proven scientifi and practical information has been developed that can be applied t insure conservative use and management. Our present need—and i is each year becoming more important—is to apply that knowledg in the everyday operations involved in resource management. Continued adherence to old, established, but wasteful, practices of lan use and cultivation is the principal difficulty to be met in securing th acceptance of better methods. More determined efforts are necessar to stimulate interest in the conservation of our natural resources, an it is to be hoped that we will not have to wait for some disaster to driv the lessons home.

The Department of the Interior in the administration of the lands under its jurisdiction has a large and complex soil-conservation problem to solve. Every land-management agency of the Department is faced with soil-conservation problems on every hand due to past misuse. This observation applies to the national parks and monuments, the wildlife refuges, lands held in trust for the Indians, the public domain, and the reclamation lands. Some areas have lost an appreciable part of the original value, and other portions have been irreparably damaged. Each year that correction is deferred the loss increases in extent.

The land-management bureaus of the Department, in cooperation with the Office of Land Utilization, have developed comprehensive plans for the correction of erosion problems, the restoration of depleted soils on arable lands, and related conservation practices for the lands under their respective jurisdictions. In preparing these plans, primary attention has been given to the use of proven practices and procedures in the field of soil and water conservation. A large and growing backlog of such plans now exists.

With the limited funds heretofore appropriated, soil-conservation treatment has been applied to about 22,000,000 acres. This is only a small portion of the 134,000,000 acres on which the soil is seriously depleted and for which detailed plans have been made for treatment. On an additional 86,000,000 acres on which some work is needed now, nothing is being done, nor can any corrective measures be initiated with the funds annually available. Out of the total area of 282,000,000 acres of public and Indian land, only some 60,000,000 acres are reasonably safe for the future.

In this vast area are soil and related resources of vital importance to the continued welfare of this country. Every facet of our civilization is affected in some degree, whether it be in connection with the reclamation program, the national parks and monuments, the far-reaching expanse of the public range, the soil that is the basic wealth of the Indian, or the maintenance of our wildlife refuges. From these areas in large part we obtain food and fiber, as well as recreation and inspiration. Undoubtedly, the Nation would rise up in all its strength to prevent these resources from being taken from us by some foreign power, but we sit by, more or less idly, and watch them disappear—slowly it is true, but none the less surely—through wind and water erosion.

FOREST MANAGEMENT

The governing management policies of the Department covering the forest resources under its jurisdiction were advanced materially during 1949. More adequate protection from fires, insects, and diseases was afforded to all lands, and the program leading toward intensive forest management was expanded.

Adequate protection from the ravages of fires, insects, and diseases is essential to good forest management. Fire control was signally successful with only 320,646 acres of Federal land burned over, which is only eight-hundredths of 1 percent of the total area requiring protection. This is the best record the Department as a whole has ever experienced. Approximately 5,000,000 ribes bushes were destroyed in the program to protect the white pine forests from the ravages of the blister rust. Prompt and effective action was taken against many forest insect infestations, the principal control projects being against the spruce budworm attacking Douglas fir in western Oregon, and the mountain pine beetle infesting lodgepole pine in western Wyoming. These latter two projects were successfully prosecuted under coordinated plans formulated by this Department, the Department of Agriculture, and the States involved.

Development of the Department's commercial forest resources continued at a high level during the year, although considerable slackening of sales was evident toward the year's end. However, for the year the forests of the Department produced 1,134,000,000 board feet of timber valued at $10,200,000, which is the greatest return ever recorded. This was achieved at a cost of $3,285,000, including slightly over $1,000,000 for the protection of the national park forests which return no direct revenue.

However, much remains to be accomplished. More adequate protection from fire is required for the forests on the Indian reservations and public domain lands. Additional funds are necessary for the maintenance of timber roads within the Indian, O. and C., and public domain forests. Likewise, the personnel charged with forest administration requires considerable augmentation if intensive management is to be achieved. The progress made during the year can be viewed with much satisfaction, but the fact should be recognized that the forests under the jurisdiction of the Department are not yet being managed at the high level which the value thereof justifies.

LAND CLASSIFICATION AND LAND POLICY

In connection with its review of policies for determining the types of public land which should be retained in public ownership and those which may be transferred or leased to individuals under various public land laws, the Office of Land Utilization examined the records of 133 applications for entry, selection, or location of public land, and 27 applications for grazing leases or permits, which were appealed to the Office of the Secretary from adverse decisions by the Bureau of

Land Management. For each application, a recommendation on the disposition of the case was made to the Solicitor.

The Office contributed to the report of the Council of Economic Advisors. It prepared material for inclusion in the presentation of the program of the Department of the Interior before the Senate Committee on Interior and Insular Affairs and the House Public Lands Committee, in January 1949. It assisted in the preparation of the report to the Bureau of the Budget on the recommendations of the Commission on the Organization of the Executive Branch of the Government concerning the Department of the Interior.

The Director of Land Classification served on a committee which held hearings and made recommendations to the Secretary concerning the adoption of a 40-hour basic work week for employees of national park concessioners, and continued to serve as liaison officer for the Department with the Advisory Committee on Conservation.

WATER RESOURCES COORDINATION

During the year, agencies of the Department, acting through the Water Resources Subcommittee, reviewed 33 river and harbor and flood control reports of the Corps of Engineers, Department of the Army, concerned primarily with flood control and navigation, and 16 basin and project reports of the Bureau of Reclamation concerned principally with irrigation. Proposed projects by both agencies also have incidental power, flood control, and water conservation benefits. The agencies also reviewed 62 applications for power permits and licenses referred to the Department by the Federal Power Commission. Recommendations were formulated for all projects designed to protect the varied interests of the agencies of the Department, and to assure, so far as compatible with the primary purpose of the proposed projects, that in their design, construction, and operation, appropriate consideration would be given to all uses of water.

The Water Resources Subcommittee maintained liaison with the Interior Department Program Committee, the Missouri Basin Field Committee, and the agencies participating in the Missouri Basin program, in order to assure proper coordination of the program as a whole.

The executive officer of the Water Resources Subcommittee acted as alternate to the Department's representative on the Federal Inter-Agency River Basin Committee, and until January 1, 1949, as secretary of that committee. Agencies were kept advised throughout the year of action by the Federal Inter-Agency River Basin Committee, its three field committees (Missouri Basin Field Committee, Columbia Basin Inter-Agency Committee, Pacific Southwest Technical Committee), and its technical subcommittees (hydrologic data, sedimentation, benefits, and costs), and other inter-agency working groups, in order that agencies of the Department might actively participate in these technical coordination activities in which they are especially interested.

In connection with departmental operations, the agencies represented on the Water Resources Subcommittee were given full opportunity to review programs prepared at regional level by the Department's field committees, and also to participate in the formulation of interstate water compacts through the designated Federal representatives.

Bureau of Land Management

Marion Clawson, *Director*

INTRODUCTION

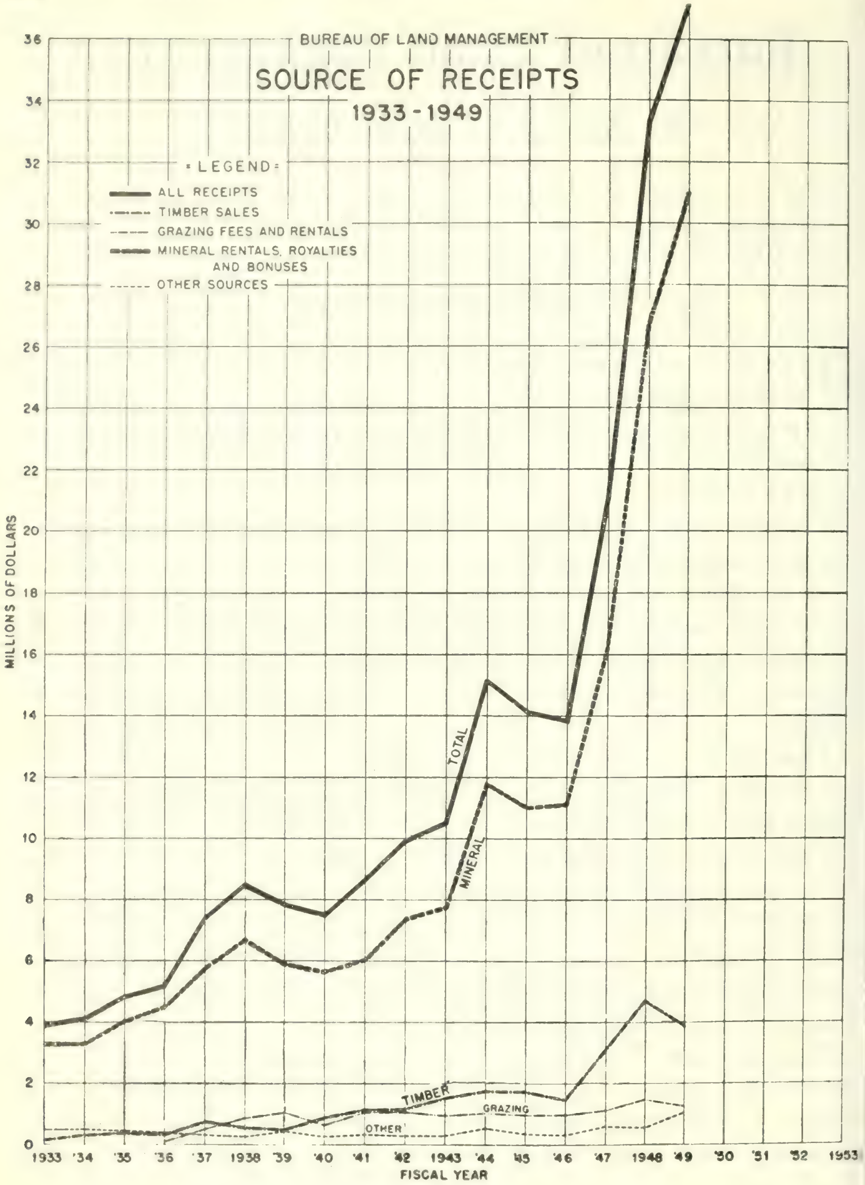
BETTER and more economic administration, conservation, development and use of natural resources on the public domain has been achieved the past year through the Bureau of Land Management's decentralization program which was placed into full-scale operation on July 1, 1948.

This 137-year old Bureau, which is paradoxically both one of the youngest and oldest agencies in the Federal Government, is continuing to streamline its organizational structure so that it will be better able to fulfill its obligations as a management program. This agency was formed in 1946 through the consolidation of two Interior Department agencies: The General Land Office (1812) and the Grazing Service (1934).

The Bureau has primary responsibility for administration of approximately 180 million acres of public land in the continental United States and 290 million acres in Alaska. In addition, it is responsible for the leasing of minerals on most Federally owned lands, totaling 700 million acres, and on about 50 million acres of privately owned lands, in which the United States Government has mineral rights. Wise management and conservation of natural resources on public lands is a paying proposition as shown in the financial record. The Bureau of Land Management last year collected more than 37 million dollars for the Government from the management of public lands under its jurisdiction. This is the largest amount collected in its history. The management of public lands is profitable not only to the Federal Treasury but to the States and counties which contain public lands within their borders because 13.3 million dollars of the above were turned over to States and counties as provided by law.

The return of $37,149,433.89 from the management of the public lands during the fiscal year 1949, when compared with expenditures, represents a ratio of approximately $7 return for every $1 of appropriations.

The Bureau's work includes providing free services as well as undertaking the money-making management jobs that produce royalties on

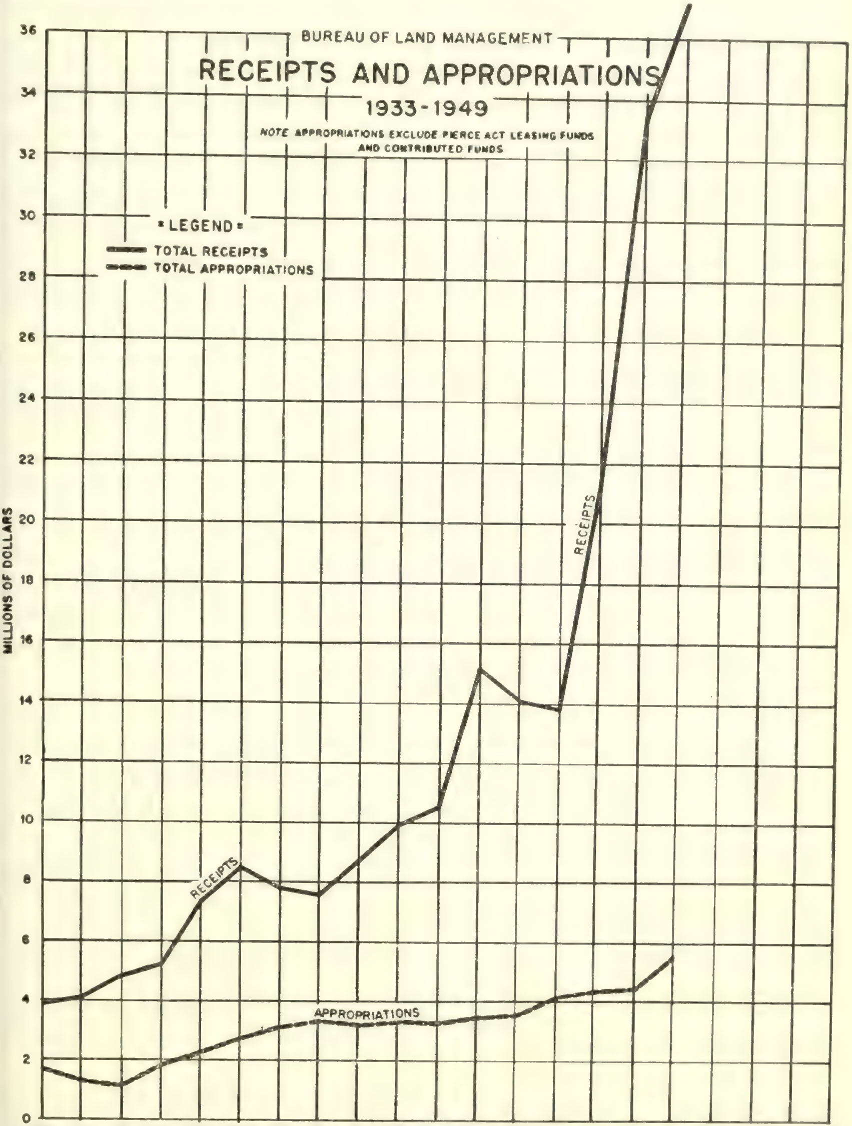


petroleum and other minerals under the mineral leasing act, revenues from timber sales, and the grazing use of public lands.

Receipts and appropriations for 1933–49 are shown by the chart on page 223.

Increased revenue from public lands, though due in part to higher prices, has actually resulted from greater use of the public lands. Petroleum production on the public domain has trebled between 193 and 1949. Natural gas production has more than doubled in the same period. The total of 31,000 applications filed for land use in 1949 is more than three times the 9,000 which were filed in 1940.

The Bureau of Land Management is now able to give better service to its customers—the American citizens. Under the decentralization plan, the Bureau of Land Management's goal is a dynamic program for resource management.



In general, three types of public service are provided through the Bureau of Land Management administration of natural resources of public lands. The first of these services is the low cost or free service relating to the public domain and the property rights in private lands once part of the public lands. Included in this category are the execution of cadastral engineering surveys, the furnishing of copies of plats of surveys, and other data relative to legal title to the land originating in or still remaining in the public domain and the disposal of these tracts under the homestead, mining or other laws.

The adjudication personnel process all applications for public land use, except grazing privileges within established grazing districts which are administered by the Division of Range Management. The cadastral engineering personnel make the surveys prerequisite to all public land use. During the past year the work of both groups has been speeded up and the backlog of cases reduced. The Bureau of Land Management is the repository for records of disposal of lands under the public land laws. These records are referred to by thousands of individuals each year to establish legal title to their land.

The second type of public service relates to the permitted use of the public range lands for grazing purposes, the lease and sale of small tracts of the public lands for home sites, camp sites, etc., and special permits at nominal fees for usage of the public lands set forth in specific laws. Fees for use of these lands are determined by various considerations. Usually they are barely equal to administrative costs.

Third, there is the service of making available resources from the public lands for a consideration which is near the commercial value. This type of service involving essentially the timber, oil, and gas and other mineral resources on the public lands, constitutes a major part of the Bureau's revenue-producing operations.

Finally, the Bureau continues to dispose of land under the homestead, desert land, public sale, recreational, and exchange acts, whenever such lands can be classified as suitable for disposal under section 7 of the Taylor Grazing Act. While as noted above, the acreage disposed of is now relatively small, the function of determining which of the public lands may be disposed of without impairing the administration of the remaining public domain or the private economy remains an important one.

Range and timber management programs of the Bureau of Land Management make valuable contributions to local and national economies through the conservation, development, and use of grazing and timber resources.

Because the public range is an integral part of many ranch operations in the West, the management of Federal grazing areas is an important element in national meat and wool production. With more than 8 million head of livestock using forage and water resources on public lands, some through seasonal use and others in year-round grazing, the stability of the industry is in considerable measure dependent upon the use of the public domain under leases, licenses, or permits issued by the Bureau. The management of range lands is also designed to take into account the wildlife resources and the enjoyment by the general public. Soil and moisture conservation are fundamental to the local and national economy as well as to the protection and rehabilitation of range land and the development of the river basins.

The problem of timber resource management is of national interest. The Congress recognized the wisdom of sustained yield forest management practices—namely, the maintenance of a reasonable balance between the volume of tree cutting and tree growth so as to insure a continuing supply of forest products—by authorizing the application of this policy on all of the commercial forests on the public lands of the United States.

There are approximately 28 million acres of public domain timber land and woodland in the States. These areas contain valuable stands of Douglas fir, ponderosa pine, white pine, and other species of commercial importance, as well as large amounts of juniper, pinon pine, and related woodland types which are needed to supply local demands for fence posts, fuel wood, mine props, and other products. Total timber resources in the public domain of the United States other than woodlands have been estimated as having a present market value between 50 and 100 million dollars. The administration of the sustained yield policy involving these resources has been vested in the Bureau.

In addition, the Bureau has special timber management problems on 125 million acres of forested public land in Alaska and in the 2½ million acres of Oregon and California revested railroad grant lands in western Oregon. In the latter area, constituting one of the largest sustained yield forest management "laboratories" in the world, important policies for cooperation between Government and private landowners and timber operators are being worked out to provide more jobs, homes, and businesses.

Conservation and harvesting of the products of the public lands, including forage from grazing land, timber from forest lands, and minerals from all of the public lands, is an entirely different type of activity than the simple land disposal of the homestead era of former days.

Lack of supervision over the use of watersheds and range lands means denudation, disastrous erosion, and in many areas serious floods. It also means little or no revenue from the use of the lands.

Another major management program of this Bureau, in addition to timber and range land, is on mineral lands of the public domain. Mineral leasing on the public domain has resulted in important revenues and good conservation practices in the development and mining of valuable minerals. Industrial development in many areas is dependent upon the utilization of the mineral resources contained in the public land. In addition to oil and gas wealth from the public domain there are important deposits of phosphate and potash in the West—valuable fertilizer elements needed to rebuild depleted soils for soil conserving cropping systems and for a permanent agriculture throughout the Nation.

Conservation, continued wise development and use of natural resources on the public domain is important to every American citizen. Modern management practices of the Bureau of Land Management help to stabilize local and national economy, fortify the Nation in war and peace, by providing raw materials necessary for continuous production, and assure future generations of their rightful heritage of natural resources.

DECENTRALIZATION AND ORGANIZATION

Although all divisions in the Washington and field offices have shared in the work load, the burden of responsibility for effecting the decentralization program has fallen to the Office of the Chief Counsel, the Division of Administration and the Division of Adjudication. Other major activities, such as range management, had previously undergone a partial reorganization process, 1946, in the consolidation of the Grazing Service with the General Land Office to form the Bureau of Land Management.

During the fiscal year 1949, necessary delegation orders were drafted by the Office of the Chief Counsel to effectuate decentralization. Prior to the end of the year, a general departmental delegation order to the Bureau of Land Management and a Bureau delegation order to the field were prepared to simplify and consolidate many separate orders previously in effect.

In connection with the field organization of the Bureau, the Office of the Chief Counsel prepared orders consolidating the land offices in Oregon, Idaho, New Mexico, and Colorado.

During the year the Washington office transferred many trespass cases to the regions, to be handled on a local level by the regional counsels, and by the end of the year the Washington office was handling only those cases arising in region VI and those involving litigation by the Department of Justice.

One of the major jobs after the work of decentralization was well under way at the end of the fiscal year, was the revision of the regulations in preparation for the 1949 Code of Federal Regulations. Another important job, relating to regulations, was in the field of mineral leasing.

Legislation

No public-land legislation was acted upon in the special session of Congress (July 26 to August 7, 1948). In the first part of the fiscal year, the Office of the Chief Counsel prepared the Bureau's legislative program for the Eighty-first Congress. Twenty-eight proposed bills were drafted or redrafted for introduction along with the letters of transmittal. After Congress convened, reports were drafted on 81 bills by the end of the fiscal year.

The Bureau's interest in legislative matters affecting Alaska continues at full pace. The Sale bill (H. R. 2859) resulted in Public Law 275 (81st Cong.) authorizing Government to sell tracts of public land in Alaska for industrial and commercial purposes, including housing, and contains certain safeguards against speculation.

Another Alaska bill (H. R. 4542) providing for the classification of lands in Alaska, is now before the House Public Lands Committee. House bill 4289, requiring settlers to record their claims in the district land office, passed the House and is now before the Senate. Material on the Alaska Statehood bill and on the extension of the Housing Act to Alaska was also prepared in the Chief Counsel's office.

With respect to mineral legislation, the Bureau's main activity has been the preparation of a draft of general revisions of the mining laws. This has received considerable attention in the Department and in the industry and is now being studied by the National Minerals Advisory Council.

Another important bill (H. R. 2914) would amend the Taylor Grazing Act in several ways. It would eliminate the acreage restriction on grazing districts, establish uniform requirements affecting the exchange of lands in or outside of the district and revise the public sale law to expedite action on sales. This bill passed the House and awaits action by the Senate.

Two other significant Bureau-sponsored bills are House bill 2821 to extend the Recreation Act to all public purposes and to permit nonprofit organizations to lease public lands for certain purposes, and House bill 2820 to extend the small tract act partially to unsurveyed lands, to provide for community-site disposals, and to permit associations, corporations, States, and political subdivisions to secure the benefits of the act. Both have passed the House and now await action by the Senate. Enactment of these bills would eliminate the necessity for a large number of private bills which we now have, and would also make it possible for a large number of meritorious projects to be carried out.

Other important bills now before Congress are House bill 2753 relating to the cultivation of additional homesteads; House bill 3150 relating to modification of the rectangular surveys where necessary; House bill 3575 repealing obsolete private-sale laws, all passed by the House; House bill 5122 requiring the recordation of scrip rights; Senate bill 1979 authorizing the reorganization of district land offices without regard to State lines; House bill 1560 to establish a central record of title of all Government lands; and Senate bill 148 to settle the jurisdictional controversy on O. and C. lands.

ADMINISTRATIVE PROGRAM

The Division of Administration was actively engaged in all aspects of the reorganization and decentralization programs and made unusual progress in the fields of accounting, public domain records, file records, personnel, management planning, and general administrative services.

The Division of Administration, primarily responsible for the presentation of the budget, spent considerable time in attempting to give the Bureau of the Budget a realistic picture of its activities.

Increased Efficiency Results

In August the Branch of Management Planning was created and through its efforts appreciable improvements were made in procedures, methods, and organization of the Washington office. These efforts were reflected in the increased efficiency in many units of the Washington office, particularly the Correspondence Section, Mail Room, and Patent Section.

Personnel Management Improvement

As the result of a position classification survey, the allocation of field positions in accordance with standard organizational patterns was completed. The use of master position descriptions was introduced to eliminate paper work and speed appointments. The Bureau staff was realined in accordance with budgetary and organizational bounds through transfers and reduction in force. Consistent with decentralization of other authorities, and, to expedite personnel actions, the appointing authority of regional administrators was expanded to include all positions except those in P–3, CAF–8, and above. The efficiency-rating program was conducted with a truer sense of performance evaluation and was one of the Bureau's principal tools in a campaign to improve supervision. During the year, 6 Bureau employees were cited with the distinguished service honor award, 10 received citations for meritorious service, and 38 for commendable service. The number of Bureau employees, permanent and temporary, varied from 1,092 on February 28, 1949, to 1,353 on June 30, 1949.

Supplies and Equipment

The Branch of Administrative Services had a difficult job to perform under severe handicaps as the decentralization and reorganization, as well as the improved procedures, were constantly requiring revision of old forms and preparation of new ones. Improvement was made in furnishing supplies and equipment to the Washington personnel. The Branch was called upon to fill many unusual requests made by the various field offices.

Accounts Receivable to Field Offices

Considerable progress was made in modernizing the Bureau's accounting procedures. Pilot studies were conducted in cooperation with the General Accounting Office as a result of which the Accounts Receivable were decentralized to the regional offices.

Modernize Old Land Records

Another important job was the reorganization of the record-keeping functions of the Bureau, which is responsible for the maintenance of complete records on the survey, disposition, and reconveyance of the public domain.

As a result of improvements, a large backlog of recording and status actions was reduced and the work brought to a current basis. It has been recognized for many years that drastic improvements were necessary to bring these land records into harmony with modern recording processes and to provide a means of preserving the basic survey field notes and township plats and the tract book references, which provide the only over-all reference to all public land transactions. Through cooperation with the Bureau of the Budget an item of $10,000 was placed in the 1950 appropriation act for the microfilming of approximately 6½ million patents as the first step in the record modernization.

The Branch worked closely with many Federal and private firms in developing the modern procedures which have been recommended and with which the Bureau of the Budget is in full accord.

Progress has also been made in removing from the Mail and Files Section land records to the National Archives and the disposition of material considered obsolete. The Mail and Files Section, through improved procedures, is now handling its work on a current basis as compared to a 2-week backlog at the beginning of the fiscal year, while at the same time reducing its staff from 22 to 16.

Future Administrative Goals Listed

The Division is continuing its aggressive activities on all fronts in order to make the Bureau's operations as efficient as possible. A number of projects in accounting, public domain records, file records, personnel, management planning, and general administrative services, are now receiving active consideration. Some of these depend upon appropriations, such as the public domain records project referred to. The Division is constantly seeking improvements in all the Bureau's activities. It realizes that in the future most of its consideration must be given to the field operations.

The Branch of Management Planning is continuing its studies and recommendations with much more emphasis and consideration being given to the Bureau's operations in the field, in view of the decentralization of approximately 85 percent of the work to the field.

Plans are being made for progressive steps in the broader field of personnel management. These will include supervisor training, maximum utilization of employee skills, on-the-job training, more effective promotional system, and related personnel problems.

Under the law creating the General Services Administration it is planned to make many improvements which will expedite the securing of forms, supplies, equipment, etc. Complete inventories of supplies and equipment will be made and the proper controls established. New purchasing and procurement procedures will be prepared, to be embodied in the Bureau of Land Management Manual. Greater effort will be made to have on hand sufficient supplies of all forms, particularly those in great demand, such as oil and gas lease forms, public sale, grazing leases, etc.

It is planned to continue accounting surveys and studies in order to make this phase of the Bureau's operations as efficient and expeditious as possible. Very serious consideration will be given to the possibility of having the District Land and Range Management offices perform all the accounting work. Studies now under way indicate great savings in time and personnel will result if this is found feasible.

It is hoped the Branch of Records will be able to carry on its aggressive modernization program more intensively than ever, in view of the item covered in the current appropriation act. Preliminary plans and procedures are being developed to carry out other phases of this program, such as the microfilming of the survey notes and township plats, and the development of many additional procedures leading toward the complete reorganization of the public domain land record system. It is hoped that eventually it will be possible for the people in any of the public domain States to obtain copies of any records from their local land office rather than coming to Washington as is now necessary in many cases.

ADJUDICATION ACTIVITIES

Adjudication activities during the past year reveal a tremendous volume of new business as well as old business for Bureau of Land Management.

Backlog of Cases Reduced

In spite of reduced personnel, the Bureau closed 34,217 cases or 8,670 more cases than in the previous fiscal year, when the record was 25,547 cases closed. The disposal of cases per employee per month has risen from 6 cases in 1945 to 12 cases in 1948 and to 21 cases for the past fiscal year. It is noteworthy that operations under the decentralization program have resulted in better service to the public and have facilitated the disposition and use of public lands and resources.

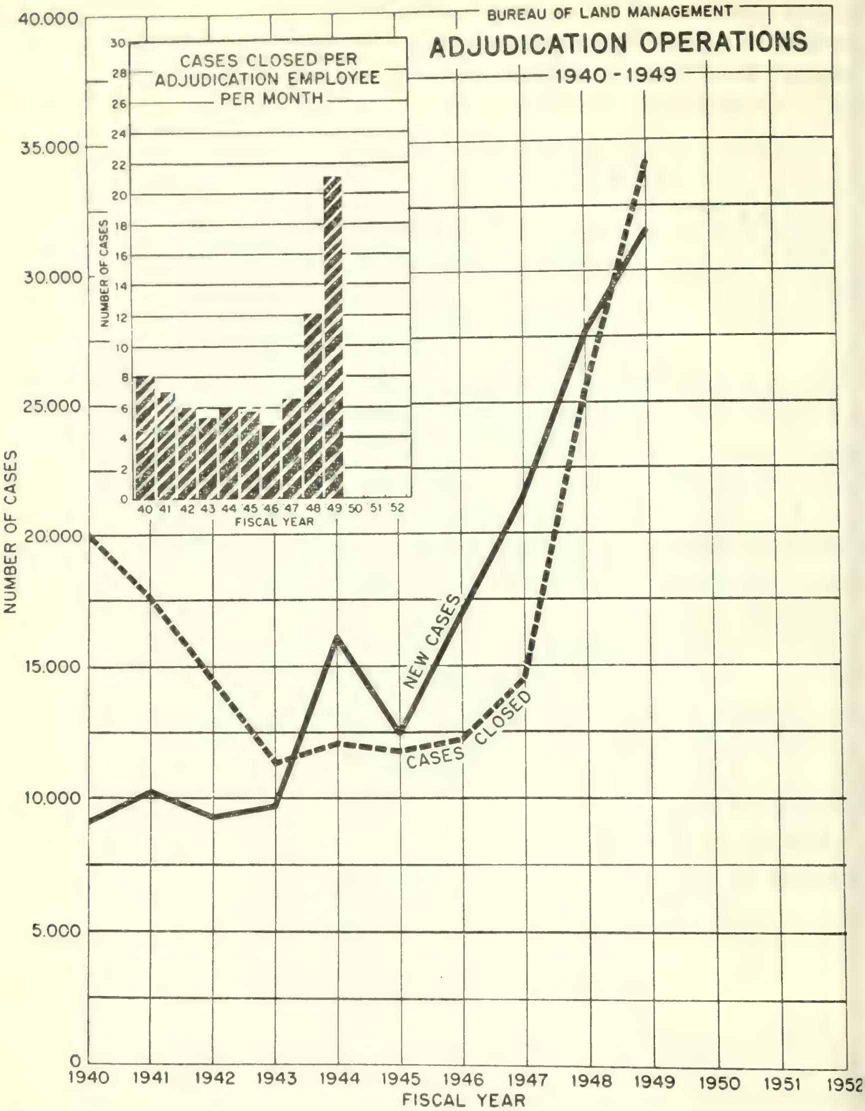
During the past 25 years there has never been a period in which the number of public land applications were so heavy as they are now, nor in the recollection of any present employee of this Bureau has the output been so great. This increase in production is attributable to the following factors: (1) Higher morale, (2) decentralization which eliminated unnecessary delaying steps, and (3) improved work procedures.

During the last half of the year, progress was made in reducing the backlog of competitive oil and gas leases on public lands as well as that of applications for permits and leases on lands acquired by the United States.

Field Handles Many Cases

Field personnel handle many types of cases including small tract, homestead, reclamation homestead, desert land, Indian allotments, cemetery sites, fur farm, grazing, shore space restorations, trade and manufacturing site applications, homesites or headquarters, certain rights-of-way, leasing of public land near or adjacent to springs, reservoirs, special land use permits, applications for the development and utilization of underground waters in Nevada for irrigation purposes, public sale applications, and sales of timber. Experience under decentralization has been so favorable that the agency contemplates delegating additional categories of cases to the field.

The Washington office has retained adjudication of State and railroad grants, scrip, and several other types of highly specialized work. This office also processes forest, State and private exchanges, color of



title cases along the Cimmaron Base in Oklahoma, restorations from military withdrawals, opening of townsites, competitive oil and gas leasing, potash, sodium and mineral leasing on acquired lands, and issuance of all patents. Patents are now issued within 30 days of the receipt of orders.

Choctaw-Chickasaw Lands

During the fiscal year the Bureau assumed jurisdiction of 373,826.40 acres of coal and asphalt lands under the terms of a contract between officials of the Choctaw and Chickasaw Nations and the Secretary of the Interior. It is estimated that these lands could produce 692 million tons of readily available coal and reserves of 965 million tons. The first coal permit involving these lands has already been issued. A problem of dealing with persons who formerly occupied these lands under agreements with the Indians is also involved. A satisfactory answer to this problem may be additional legislation.

Lands for Airport Use

Lands have been conveyed for use for airport purposes under Section 16 of the Federal Airport Act to Carbon County, Utah, city of Milford, Utah, and the city of Rawlins, Wyo. In accordance with the provisions of the act, the lands were granted on a gratuitous basis for airport purposes. Several other similar requests are pending before the Bureau.

A new policy of public land disposal has been inaugurated under which isolated and scattered tracts will be examined, classified, and advertised for sale by competitive bidding without any application being filed. It is anticipated that the new system of disposal will be applied to lands still remaining public in the Southern and Middle Western States.

Revised Phosphate Rules

Revised phosphate regulations, Circular 1722, were approved on January 14, 1949. These regulations provide for noncompetitive as well as competitive leases whereas the provision for noncompetitive leases was not contained in the prior regulations.

This Department and the Atomic Energy Commission concurred in holding that fissionable minerals are subject to location under the United States mining laws.

Mining Claims

Legislation was enacted suspending annual assessment work on mining claims. It differed from previous legislation by allowing credit for the year ending at 12 o'clock noon on July 1, 1950, for assessment work performed for the year ending 12 o'clock noon on July 1, 1949. A permanent act, that of June 21, 1949, provides for temporary deferment by the Secretary of annual assessment work in certain unavoidable contingencies. Regulations under that act are being processed. This act and the acts of 1910 and 1940 enlarge the scope of the claims for damages of the surface owners under section 9 of the Stockraising Homestead Act by reason of mining operations of mineral claimants.

Adverse proceedings were instituted against a large number of mining claims in the Tonopah Bombing Range, Nev. Numerous mining claims for lands included in the Naval Ordnance Test Station, Inyokern, Calif., against which adverse proceedings had been instituted, were processed, and most of the claims were declared invalid.

Oil and Gas Leases

During the past fiscal year there were 16 sales at competitive bidding of leases of lands within known geologic structures of producing oil and gas fields in the States of Colorado, Kansas, Louisiana, Montana, New Mexico, and Wyoming. The total acreage of the public land offered in these sales was 5,685.12 and the aggregate amount of the bonuses paid by the successful bidders at these sales was $177,973.39.

It is noteworthy that 23,234 mineral leases and permits were outstanding on June 20, 1949, as against 14,631 on June 30, 1948.

Change in Lease Laws

Several amendments to the regulations governing permits, leases, and licenses under the Mineral Leasing Act of 1920 were approved. Among these were the requirements that after March 1, 1949, a $10 filing fee must be paid as a service charge for processing requests for assignments of all interests in an oil and gas lease, except royalty interests.

Withdrawals

During the fiscal year 1949, 6,344,782 acres of public land, withdrawn for military and other purposes, were restored from withdrawal.

CADASTRAL ENGINEERING ACTIVITIES

The Bureau of Land Management is charged by Congress with the official surveying and resurveying of the public lands in the continental United States and Alaska. These surveys create land boundaries, identify the lands, determine areas, furnish legal descriptions for title purposes, and actually mark the lines on the ground by establishing substantial monuments.

Surveys Prerequisite to Land Use

The identification of land areas by cadastral surveys is a prerequisite to the acquisition or use of the lands in connection with the development and settlement of the country and for the proper administration of all activities involving the management of the public lands. The rectangular system of surveying the public lands was inaugurated under the ordinance passed by the Continental Congress on May 20, 1785. The public land area, including at its maximum extent the

Territory of Alaska, the States of Florida, Alabama, and Mississippi and all States except Texas lying north and west of the Ohio and Mississippi Rivers, was subject to survey under this rectangular plan.

Since 1785 the official surveys have been extended over approximately 92 percent of the total area of the public land in continental United States. About 116 million acres remain to be surveyed in the States. In Alaska only 2½ million acres, or less than 1 percent of the total area of the Territory, has been surveyed. The value and future need of timber and the potential mineral deposits in the unsurveyed areas constitute one of the primary needs for the completion of the original surveys.

Alaska Survey Needs

In Alaska, as well as in the States, due to the lack of appropriations, the Bureau of Land Management has not been able to keep current with the demand for surveys. That situation in Alaska was remedied to some extent by increasing field activities twofold. This made it possible to survey about 22,000 acres in the Chena River and Tok Junction areas and along the Richardson Highway; 143 individual tracts, scattered throughout the Territory, and the townsites of Dillingham, Pelican, Portage, and Tok, embracing a total of 571 townsite lots. Plans are being made to accelerate materially the present Alaskan cadastral survey program in 1950.

State Surveys

The program in the States was directed to take care of the important projects requested by the Government agencies and to survey and resurvey those areas necessary to administer properly the public land.

The major projects included the survey or resurvey of: 1,336,619 acres in Colorado, Kansas, Montana, Nebraska, North Dakota, and Wyoming for the Bureau of Reclamation in connection with the development of the Missouri River Basin and 3,390 acres in Arizona on the Yuma project; 7,000 acres on the Yuma Indian Reservation, Calif., for the Bureau of Indian Affairs; 121,291 acres in national forests in California, Colorado, Idaho, Nevada, Oregon, Utah, and Washington for the Forest Service; 2,560 acres in California for Department of the Army, in connection with the Folsom Dam and Reservoir; 85,784 acres in California, Colorado, and Wyoming for the identification of the boundaries of land leased for oil and gas or coal; 460,158 acres in Arizona, Colorado, Nevada, New Mexico, Oregon, Utah, and Wyoming, necessary for the management of the public lands in connection with grazing activities, timber sales, trespass cases, control for mapping programs and areas administered under the Small Tract Act.

RANGE MANAGEMENT PROGRAM

As of June 30, 1949, the Bureau of Land Management is responsible for the management of the range resources on a total of about 184.5 million acres of land situated in 16 of the Western States. The area within grazing districts includes approximately 134 million acres of unreserved public land, 13 million acres of reserved public land, and 1.5 million acres of non-Federal land administered by agreement and through Pierce Act leases. The unreserved land outside of districts totals nearly 36 million acres.

More than 100 million acres of these public lands are important parts of the watersheds which furnish water to the major irrigation and hydroelectric power projects of the West. The value of the water resources of the drainage basins and the dependent installations are popularly known. Regrettably, however, the deterioration of the watershed lands and particularly those in critical erosion areas is not as widely recognized. A disproportionate amount of silt going into the turbines and canals of the downstream developments comes from the public lands. Thus, in addition to their grazing resources being an essential link in the year long operation of the western range livestock industry, the public lands are extremely important in the broader, multiple-use functions serving to strengthen the regional as well as the national economic stability.

Administration of Grazing

Impetus to range management activities was added through the enlargement during the year of grazing district and regional office staffs. The increases of 51 field employees to districts and 6 to regions, equivalent to an over-all increase of 49 percent, permitted the absorption of the added work load connected with decentralization to district areas of section 15 grazing leases and other types of land cases, and administration of title III, Bankhead-Jones Act, lands newly transferred to Interior from Agriculture. In the main, these new responsibilities offset the increases in manpower although general improvement in administration was possible in restricted areas which received comparatively less new work.

The lack of greater over-all benefit from the enlarged staff is attributable to the fact that the organization as expanded in 1949 is still 69 positions, or 38 percent short of the minimum staff required to administer adequately the public lands in accordance with the provisions of the Taylor Grazing Act. Added to this shortage was the diversion of many man-months to the snow campaign during the winter of 1948–49.

Range Conditions

The winter of 1948–49 will long be remembered for its extremes in snow, wind, and cold, which combined to create the most hazardous winter for ranching people, livestock, and wildlife ever experienced in a large part of the West. The rigors of the winter were more critical also because of the preceding serious drought which prevailed over most of the area, having resulted in lowering of feed supplies and condition of livestock and game. Winter death loss of animals, averaging from 5 to 10 percent above normal, was not nearly as great as anticipated at the height of the stormy season. In some individual herds, however, 25 to 50 percent of the animals died. The winter kill in upland birds, other than sage grouse, was materially above average. Eastern Nevada, Utah, northern Arizona, northwestern New Mexico, northwestern Colorado, southern and eastern Wyoming, and southeastern Montana were the most critically affected areas.

Throughout January, February, and most of March, Bureau of Land Management men and facilities in these areas, cooperating with other Federal and State agencies, fought to open roads and communications to ranches, livestock, and big game marooned time and again by constant and deeply drifting snow.

Fortunately the snow melt was gradual, run-off was unusually light, and most of the moisture percolated into the soil to recharge ground water supplies. There were no floods of any consequence resulting from melting snow. This was followed in most of the snow area by unusually favorable spring rainfall, the combination of the above-average winter and spring moisture resulting in range conditions rated by some stockmen as equal to or better than any they had experienced.

Grazing Within Districts

Grazing uses requested and authorized in districts during 1949 indicate a further continuation of the shift from sheep and goats to cattle, which trend was thought to be leveling off in 1948. Numbers of sheep dropped from 6,624,666 and goats from 40,339 in 1948 to 6,378,554 and 31,650, respectively, in 1949. Horses also declined from 92,795 to 84,244. Numbers of cattle, however, increased from 2,115,261 in 1948 to 2,217,007 in 1949. The net result was an increase of 42,235 animal units.

Despite the increased numbers of animal units permitted in 1949, the amount of forage obligated for the authorized use declined 154,170 animal-unit months. The reason for this paradoxical situation is not clear. The fact that there was a similar shifting in 1948 as compared to 1947 indicates the possibility, however, that there may be a definite trend toward lightening the grazing on the Federal range and increasing the use of ranch properties proportionately.

There was but slight change during the year in the issuance of term permits. A total of 21,081 annual and 10-year term permits were in effect, about equally divided between the two classes of tenure. It is impossible with the present staff to obtain the range and ranch property surveys necessary to the issuance of term permits. It is estimated, however, that when the range and ranch property data are available, fully 90 percent of the users may qualify and receive 10-year permits.

The numbers of permits and the livestock uses permitted by States, are shown in the following table:

State	Permits	Cattle	Horses	Sheep	Goats	Total livestock
Arizona	607	71, 730	1, 487	50, 221	1, 819	125, 257
California	467	96, 066	2, 867	127, 660	199	226, 792
Colorado	2, 015	186, 690	4, 023	710, 672	74	901, 459
Idaho	3, 299	235, 281	11, 502	879, 894	6	1, 126, 683
Montana	3, 258	379, 791	18, 453	615, 441	25	1, 013, 710
Nevada	1, 159	329, 913	9, 729	632, 018	251	971, 911
New Mexico	4, 030	238, 145	12, 672	579, 653	26, 031	856, 501
Oregon	1, 407	261, 823	9, 824	189, 875	----------	461, 522
Utah	3, 467	222, 429	4, 983	1, 458, 445	3, 230	1, 689, 087
Wyoming	1, 372	195, 139	8, 704	1, 134, 675	15	1, 338, 533
Total	21, 081	2, 217, 007	84, 244	6, 378, 554	31, 650	8, 711, 455

Grazing Outside of Districts

In September 1948, all case records relating to the leasing for grazing purposes of public lands outside of grazing districts in accordance with section 15 of the Taylor Act were transferred from Washington to the respective grazing district offices. The areas of responsibility of these offices include one and sometimes two grazing districts, together with the public land in surrounding areas that can most effectively be administered from the respective district headquarters. In limited areas, such as western Oregon, the grazing leases are processed by the local district forestry office.

The task of integrating this leasing activity with that of district administration has been completed. It was found that in a high percentage of outstanding leases, fee payments and lease assignments were from 2 to 4 years in arrears. With minor exceptions, this backlog has been cleared up and the work is on a current basis. The elapsed time between the filing of an application to the issuance of a lease has been reduced from a matter of years to weeks. Material decrease is now anticipated in the total of unleased areas.

The number of grazing leases outstanding as of June 30, 1949, the acreage of public land leased, and the acreage available for lease in 16 Western States are shown in the following table:

	Number of leases	Acreage leases	Acreage unleased
Arizona	880	2, 139, 438	308, 280
California	845	3, 293, 728	10, 135, 345
Colorado	791	435, 584	225, 146
Idaho	975	325, 380	158, 053
Kansas	14	1, 342	1, 681
Montana	1, 982	1, 244, 215	297, 116
Nebraska	134	11, 359	17, 358
Nevada			11, 492, 856
New Mexico	842	407, 801	99, 215
North Dakota	81	41, 620	56, 380
Oklahoma	72	7, 198	18, 759
Oregon [1]	798	584, 772	327, 043
South Dakota	390	28, 517	90, 251
Utah [2]			297, 423
Washington	557	300, 258	193, 020
Wyoming	2, 397	3, 096, 673	3, 216
Total	10, 758	12,117,885	23, 721, 142

[1] Exclusive of O and C land grazing leases.

[2] Unleased lands in Utah are barren salt flats.

Grazing Trespass—Supervision

A fair degree of orderly use has been obtained within districts and on the leased public lands outside of districts. Trespass use in numbers of livestock, season of use, and area of range is, however, far too common. These infractions are destructive to the forage and soil protective cover, deprive the Government of revenues which should be collected, and disrupt the operations of other stockmen. The additional personnel provided in 1949 resulted in increased supervision and better control within districts. It was generally possible to handle the more flagrant cases, but there were many undetected and uncorrected cases. It is estimated on the basis of reports from the districts that these cases involved an estimated 177,500 livestock which obtained 540,000 animal unit months of forage in trespass.

It has been impossible with the manpower available to provide any sort of supervision of the lands outside of districts. The lands under lease may or may not be properly managed by the lessees. The unleased lands are of the same general character as those which are leased. It is reasonable to expect, therefore, that most of the unleased lands are being grazed without authority, possibly to a destructive degree.

Land Utilization Project Area Transfer

Executive Order No. 10046 of March 24, 1949, transferred jurisdiction over certain submarginal lands purchased under title III of the Bankhead-Jones Farm Tenant Act and formerly administered by the Department of Agriculture to the Department of the Interior. By the same order, jurisdiction over certain public lands, closely associated with other title III project areas retained by Agriculture, was transferred from Interior to that Department. The acreage transferred to the Interior totaled 225,000 acres, and Agriculture received 107,000 acres. The transfer of jurisdiction was jointly determined, area by area, on the basis of which Department had preponderant interest and could provide administration most effectively in keeping with production capability. Further study and action is needed in certain remaining project areas, principally in Montana.

Central Nevada

At two meetings in December 1948, one at Tonopah, the other at Eureka, Nev., interested stockmen recommended that a new grazing district be established to embrace the unadministered lands in central Nevada. Pursuant to this recommendation, a bill (H. R. 2914) to amend the Taylor Grazing Act was introduced in the House. The bill provides for the removal of the limitation in acreage of public land in grazing districts, thus permitting the establishment of the district which will probably embrace most of the 11,492,856 acres outside of districts in Nevada. The bill was passed by the House and is now pending before the Senate.

Wildlife Management

Although the remaining vacant public lands are generally less productive than the lands that have gone into private ownership through past decades, they furnish some of the best winter range for game animals throughout the entire West and form a very substantial part of the habitat not only during the winter but also for the other three seasons. Upland game birds and migratory waterfowl thrive also, some seasonally, some lifelong, on the public lands. Estimates by the range managers indicate that more than 650,000 big game animals harvested over a million animal unit months of forage from grazing districts during 1949 fiscal year. Thus, wildlife is recognized as one of the resources of the land and is considered important in the range management work of the Bureau.

Soil and Moisture Conservation Operations

This program is concerned primarily with the rehabilitation of those public lands which are in a depleted and deteriorating condition brought about by past destructive practices and uses by man, fire, and other causes. Conservation surveys show that approximately one-half of the public land administered by the Bureau of Land Management falls within this category. Corrective treatment consisting of land treatment and the placement of structures is designed to improve the protective cover of vegetation, prevent flash floods, and thereby reduce erosion and the siltation of downstream irrigation, power, and other developments. In order to evaluate the conservation values of the various practices, an appraisal was made during 1949 of a majority of the work processed during the years 1935–48. The findings show that the majority of the projects are physically sound; 66 percent of them were beneficial to the soil, 69 percent resulted in improvement of the vegetative cover, and 80 percent aided management and use of the resources.

The soundness of the soil and moisture program is indicated by the increased interest and cooperation by the public in general and the stockmen in particular. Contributions to the program from these sources in the form of financial aid, labor, and materials now amount to 30 percent of the Federal expenditures.

The aerial pellet method of reseeding the range has not proven entirely satisfactory. Approximately 70,000 acres were reseeded by this method in the fall of 1948. In spite of the above-normal winter and spring moisture which followed, there has been an extremely sparse and unevenly distributed appearance of seedlings of the planted species. These results are similar to those on projects reseeded by the method in 1947. The earlier seeded areas show no improvement of consequence, despite more favorable moisture conditions.

During 1949 greater emphasis was given to restoration of critically depleted areas. The improvement of the vegetal cover by reseeding, brush control, and water utilization and control comprised a major part of the work program. This is reflected in the following itemization of project accomplishments:

Activity	*Amount*
Soil improvement:	
Deep plowing----acres--	4, 460
Reseeding-------do----	[1] 93, 084
Tree Planting----do----	102
Control and suppression:	
Brush control----do----	59, 125
Fencing--------miles--	147. 25
Water control:	
Canals and ditches do----	3. 75
Checks-------number--	124
Conduits---------do----	16
Contouring------acres--	2, 150
Dams detention number--	23
Water control—Continued	
Dams diversion number--	50
Dams retention--do----	261
Dikes and levees cubic yards--	239, 780
Springs-------number--	52
Terraces--------miles--	. 75
Wells---------number--	29
Other accomplishments:	
Gully control----acres--	18, 500
Streambank protection miles--	5
Water spreading-acres--	22, 541

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[1] Includes 32,860 acres aerial pellet reseeding.

Range Improvements

Range improvements are designed, located, and constructed principally to facilitate the management of the range and authorized livestock use. The 1949 program was directed largely toward maintenance of existing structures, with new construction limited to essential developments including fire breaks, fences, reservoirs, springs, and wells. The livestock industry by individuals and through the grazing district advisory boards contributed materially to the program in addition to their own improvement work done under the permit system. Examples of the degree of cooperation include $70,431 in contributions toward the total $107,112 program for the year in the Arizona-New Mexico region. In addition, permits were issued in the region for private construction on public lands amounting to $157,326, a program greater than the Bureau program as expanded by contributions. Contributions in the California-Nevada region during the year amounted to approximately $125,000 with permits issued for private improvements amounting to about $58,000. The investment, $183,000, also is greater than the funds that were available to the Bureau for range improvements in the region.

The following table shows the range improvements constructed during 1949:

Type of project and unit of measurement	Construction	Maintenance	Permits issued for private construction
Boundary marking ... miles	120	60	
Bridges ... number	4	8	
Brush control ... acres	36, 529		
Buildings ... number	2	39	10
Cattle guards ... do	28	22	
Corrals ... do	6	11	17
Ditches ... miles			2. 5
Experimental plots ... number	6	4	
Fences ... miles	480. 05	564	589. 4
Firebreaks ... do	46. 5	719	
Loading chute ... number			1
Pest control [1] ... acres	34, 000		
Pipeline ... linear feet	10		5, 280
Posts treated ... number	3, 040		
Pump project ... do		1	
Reseeding ... acres	40, 686		240
Reservoirs [2] ... number	301	152	78
Rodent control ... acres	225, 980		13, 850
Seed harvest ... pounds	11, 040		
Springs developed [2] ... number	79	127	26
Stock trails ... miles			22. 75
Storage tanks ... number	4		1
Trees planted ... do	14, 000		
Truck trails ... miles	144. 6	3, 062	
Water spreading ... acres	160		
Water troughs ... number	84		
Wells [2] ... do	61	127	28
Windmills ... do			1

[1] Grasshoppers.

[2] Stock water.

FORESTRY PROGRAM

Proper management of the forests and woodlands on the public lands can play a vital part in the conservation of all the natural resources on the public domain and ultimately in helping to assure national security.

Some important progress was made in the field of forest management in fiscal year 1949. A beginning was made on the management of the 28 million acres of Federal forest lands and woodlands under the jurisdiction of the Bureau of Land Management. Previously these lands had lacked management because of the absence of legal authority for anything more than protection. A staff of professional foresters was recruited for this program. They work out of the seven regional offices and a number of local district offices.

Legislation known as Public Law 291 which was enacted by the Eightieth Congress made the above program possible. This law authorizes the sale of live timber on the public domain thus clearing the way for resource management. These lands are widely dispersed in the western United States and can be developed into an important source of timber and other forest products for numerous communities which rely on such resources as the basis for industry and employment of labor. Large volumes of timber known to exist on these lands could only be sold and used in the past if found to be dead or seriously damaged by fire or other causes. When found to be in that condition usually it was too late to sell the timber and get it into use because of deterioration and much of it went to waste. In the long run trees that died and decayed were replaced by young trees, but, by and large, growth and decay simply offset each other without much benefit to the public. The lands were producing little if anything to compensate for the expense of protecting them against fire and they were more of a liability than an asset to the Treasury. Lands held under these conditions even though heavily forested are serving largely as areas for the storage of timber held in reserve and the productive capacity of their soil is not being utilized.

During the first year of management more than 60 million board feet of overmature timber was marked for selective cutting and sold for several times the cost of administration thereby producing net income for the Treasury. Only the mature and overmature trees are marked for cutting. The younger trees are reserved and will make greatly accelerated growth now that they are being released from the shade of the old timber. Some of the older trees are reserved when needed to provide a source of seed for natural reforesting of open spots. Such measures plus continued protection against fire, diseases, and insects mean that at long last practical management of these lands has begun. They are being transformed into areas of productivity from which a continuing succession of timber crops will be harvested with much benefit to the public.

The functions of the Bureau of Land Management's forestry staff are to implement a management improvement program and to initiate actions for solving known operational problems on Federal lands. Under the category of management improvement are: (1) protection of forest and range resources against destruction by fire, insects, and diseases on 2½ million acres of revested and reconveyed Oregon and California railroad grant lands in western Oregon, on 153 million acres of other forest and woodland on the public domain of the Western States and Alaska, and 228 million acres of forage and game-breeding areas of the Western States and Alaska; (2) marketing 650 million board feet of mature timber as an average annual sustained yield on the O & C lands and 100 million board feet elsewhere on the public domain; and (3) the development of a more vigorous growing stock of timber on the lands so that the capacity of the soil to grow timber shall be fully utilized and the annual sustained yield of timber maintained at the highest practical level.

Actions either initiated or proposed for the solution of known operational problems include intensification of fire prevention and presuppression; inventory of valuable mature timber and growing stock of younger timber on the O & C and public domain lands elsewhere in the United States and Alaska; preparation of management plans for timber and other resources; marketing programs for indicated volumes of timber based on management plans; and improvement of growing stock.

Fire Prevention and Presuppression

A prerequisite to successful management of timber and forage resources is to protect them from damage and destruction by variou destructive agencies, particularly fire. The most important problem incident to fire-protection activity are prevention and presuppression Fire presuppression includes preparations essential to speedy discovery, reporting, and suppression of fires.

During 1949 losses from forest fires were the lowest ever recorded i Alaska in the 10 years for which records have been kept. Only 5 fires occurred in the Anchorage and Fairbanks ranger districts wit a total of 41,469 acres burned. In part this favorable record resulte from intensified educational efforts to make the public more fire conscious and from other prevention measures. The cool, wet weathe experienced there during the past 2 years has been the main reason fo the abnormally low acreage losses.

The Alaskan Division of Forestry also accomplished further stride forward in fire suppression during 1949 by improving operations unde cooperative agreements with other Federal agencies and with private companies, thereby obtaining specialized services from them. Under such arrangements, the United States Army cooperates by transporting men and equipment to fires occurring on public domain, the Weather Bureau supplies daily fire weather forecasts and relays emergency messages, the Fish and Wildlife Service cooperates by taking the initiative in suppressing small fires, and the Civil Aeronautics Authority transmits fire messages and its aircraft aid in detecting and reporting fires and transporting men and equipment.

Inventory

Inventory of mature timber stands and growing stocks of younger timber is an essential requirement in planning the management of forest property. Valuable stands of timber on O & C and other public domain lands should be inventoried to obtain information on such factors as age, quality, size, and location of many commercial timber species, topographic and geographic features, location of roads, and location of wood-using industries.

A project employing aerial photography, photogrammetric engineering techniques, intensive sampling of limited areas on the ground, statistical analysis and mapping was started in a small way on the O & C lands in fiscal year 1949 and the goal is to expand it to proportions consistent with necessity in 1950 and 1951.

Considerable time was devoted by the Bureau's Alaskan Forestry Division during 1949 to the measuring of trees and gathering of the data necessary for the compilation of volume tables. Previously no volume tables had ever been prepared covering the forest species of interior Alaska. Accurate volume tables are an essential requirement in an extensive program of forest inventory.

Management Plans

Management plans for timber and other resources have been prepared in preliminary form for O & C lands. Present plans call for revision and conversion of these preliminary plans to more permanent form as rapidly as inventory data become available. Economic studies and marketing problems and engineering surveys of transportation problems are essential requirements. Substantial expansion is provided for in the 1951 budget.

Marketing

Marketing programs for indicated volumes of timber on the O & C lands have been guided thus far by preliminary management plans. Expansion to the proper volume is dependent in general upon the development of adequate inventories.

In certain localities the marketing of overripe timber and timber deteriorating as a consequence of damage by fire and other causes has been impossible because of inaccessibility. A program of public access roads has been undertaken to open up such areas for utilization. A small start has been planned for 1950 with expansion contemplated for 1951.

In 1949 the forestry staff of Region I, the northwest area, where the greatest concentration of forestry problems occurs, initiated a more systematic timber-sales procedure. During early summer, timber operators are invited to offer suggestions that certain tracts of timber be put up for sale during the following calendar year. The details of the plan are then given wide publicity. A sales program reflecting these suggestions is developed in consultation with local advisory boards and laid out in advance for a whole calendar year. The advantages of this procedure to the industry are that it gives interested operators adequate time to investigate the tracts of timber to be marketed and determine whether it fits in with their operating plans before they fully obligate their capital in other logging ventures. It also aids the forestry staff in that time-consuming and sometimes fruitless work performed as a result of indiscriminate applications will be largely eliminated. Much preparatory work for the new plan of operation was performed during fiscal year 1949 and was still in progress at the end of the year. The new procedure will take effect on January 1, 1950.

Improvement of Growing Stock

Improvement of the timber growing stock with the ultimate objective of an expanded average yield is to be accomplished by the following program:

(1) In all timber sales contracts require selective cutting wher feasible and elsewhere alternate forestry practices of proven succes for the purpose of obtaining prompt and complete reforestation o all openings created by timber removal.

(2) Concentrate timber sale operations in the stands of overrip and deteriorating timber until such stands are replaced by vigorou young growth. The lands occupied by overripe timber are mere storage areas until such timber is utilized and replaced by young timbe capable of producing wood for future use. Such conversion operations are essential to future realization of the productive capacity o the storage areas, but require careful planning and execution becaus the supply of overripe timber must last until the existing youn timber has had time to grow to maturity.

(3) Reforest all areas now in a deforested condition due to fire

or other causes on which reforestation by natural processes appears unlikely or liable to be too long deferred. It is roughly estimated that 300,000 acres require such treatment, of which one-half is O & C land. It is estimated that approximately two-thirds of the area can be reforested by the use of airplanes to sow seed. The other one-third will require hand planting of nursery-grown seedlings. A few thousand acres already have been planted. Only 9 acres were planted in 1949, and a few hundred acres are scheduled for planting in 1950. Reforestation work is to be stepped up to approximately 10,000 acres in 1951 if requested appropriations are obtained.

Overstocked stands of young timber require thinning. By such treatment mortality losses due to overcrowding are avoided and the remaining trees grow at an accelerated rate. Such timber stand improvement work has been started on a small scale on the O & C lands. Expansion of this work on a more substantial scale on a commercial basis is contemplated as access roads are extended and as markets for thinnings are developed.

FUTURE MANAGEMENT PROGRAM FOR THE PUBLIC DOMAIN

The future sound economic management and wise development and use of natural resources on our public lands is the primary objective of the land planning program of this agency.

Despite the fact that the greater part of the once vast area of public domain has passed into private hands, the remaining area constitutes an important national asset—important not only in terms of size, which is considerable since it embraces 412 million acres in the United States and 365 million acres in Alaska, but important also in its relationship to the economy and well-being of the country.

Public Land Program Vital to Natural Resources

The value of the public domain can be measured in part in terms of known resources, such as its forage, timber, minerals, and its recreation and watershed value. Less subject to measurement are those unknown values discovered from time to time and especially during periods of national emergency. Rough and mountainous, arid, wet, inaccessible as many of the public domain lands may be, they produce a substantial portion of the Nation's meat, fiber, timber, minerals, and wildlife and offer varied and material recreational possibilities. In Alaska these lands offer new and growing opportunities for farms, for homes, for industry and commerce.

Essential in War and Peace

The public land areas have always contributed substantially to the national defense in periods of emergency by providing large areas for military training. It is desirable that areas suited to these purposes be retained. Many areas reserved for military purposes during World War II continue to be utilized for training purposes. Some of these and new areas are being set aside for experimental purposes in connection with the development and improvement of military weapons.

In addition to the need of public land for national defense activities, large areas have been reserved for public land conservation programs, such as national forests and fish and wildlife refuges; and public recreation as National Parks, State, county and municipal recreational sites, and camps and cabin sites. The demand and need of public lands for all these and other public purposes continues to be great. Conflicts between public use and the present utilization of the public lands by individuals for grazing, mining, timber production, crop production and other purposes are constantly arising. In some instances there is a substantial conflict between different public uses. These give rise to many complex planning problems.

Land Planning for Better Public Service

During the year the Bureau initiated land classification studies in connection with pending withdrawals and reservations for public programs to determine proper land utilization, especially regarding suitability for the purpose desired, the extent of interference with the operations of the persons using the land, and the need for all of the land requested by other public agencies. The results of this work are starting to materialize through modifications in the areas requested to obviate the most serious use conflicts. The Bureau also initiated a program to classify lands, which are no longer needed in a public reservation to determine their proper use prior to the time they are restored to entry. This is being done in order to reduce the confusion which results when land is opened to entry and to provide better service to the public.

Management of the Nation's public domain requires a well-charted realistic, farsighted, and comprehensive course of action. Any such course of action must be in the general public interest to protect the public resources and insure their maximum utilization. In addition local problems of land use and land use relations must be recognized and brought in balance through cooperative undertakings with States counties, and municipalities. And finally, the farmer, the stockman the lumberman, the miner, and other individuals who use the public lands must receive consideration in the management program.

Consistent with the Bureau's policy of decentralizing its activities, more of the responsibility for planning has been shifted during the past year to the man on the ground, to those employees who have immediate contact with the public in the public land areas. Each employee is charged with the responsibility for making recommendations for better land use and more efficient land use procedures. These local recommendations evolve into regional programs which in turn become the basis for a coordinated, uniform, Bureau-wide course of action; thus flexibility to meet local conditions is maintained while uniformity of action is insured.

Since the Bureau is essentially a real estate management agency, its accomplishment is in part subject to measurement by the number of land-use actions which it handles. During 1949, some 10,000 land examinations were completed. This required examination of numerous tracts of the public domain for homesteads, desert-land entries, mining claims, small tracts, tracts designated for public sale, and for other purposes. A relatively new use for the public lands which has attracted much interest, especially in areas of dense and increasing population, has been for small tract occupancy. The public has desired these tracts, ranging in size from 1¼ to 5 acres, for general residence, for business, and for recreation. In 1949, some 74,000 acres of small tracts were examined, classified, and surveyed in such widely scattered areas as Florida, California, Minnesota, Arizona, and Alaska; about 5,000 applications were received for small tracts; and more than 3,000 leases were issued. Some sales of small tracts were made, the beginning of a trend toward the disposal of these tracts after they have been improved.

New Studies in Public Lands

At no time during the long period of public-domain management has there existed adequate information as to the character of the land and the character, location, and extent of its resources. Since intelligent management depends on such knowledge, the Bureau continued during the year with an inventory in two areas quite dissimilar in resources and stage of development; namely, the Missouri River Basin and Alaska. Though incomplete, the facts developed by these studies have already been invaluable in giving direction to the management program. In the Missouri River Basin, for instance, the inventory disclosed numerous isolated tracts so scattered and disconnected that they could be better used in private ownership. These tracts were examined and appraised and are now being offered for sale at public auction, thus reducing future administrative costs and bringing direct revenue to the Treasury. Another example of direct benefits from the Missouri River Basin study concerns the Wind River Basin in

Wyoming. In this basin, covering over 2 million acres, of which 1¼ million acres are public lands, the study showed its particular importance as a watershed area and, within the basin, defined certain areas on which soil- and water-conservation practices are necessary to prevent excessive siltation of downstream reservoirs. In addition, the study provided a basis for a land-exchange program to improve the utilization of public and private lands.

Alaska Objectives

In Alaska, the objectives of the land-examination and classification program are framed in terms of the management of a pioneer, undeveloped country offering great potential, but imperfectly known, opportunities for additional settlement and development. Within those areas holding greatest promise for successful settlement, the Bureau has been engaged on a land-examination program to map the areas in terms of their suitability for agriculture, for small tract use, for recreation and other forms of occupancy, and on the basis of these findings to advice the interested public of its findings. Work is going forward from the Kenai Peninsula in south-central Alaska north to the Tanana Valley and along the Alaska and other highways. The timber resources of central Alaska have been looked into. Investigation has been made of livestock production opportunity in other areas. A growing Alaska needs town sites and small tracts for residential purposes. Such sites have been examined, the lands have been classified and surveyed, and are being made available for these purposes.

Research Extended

Research and statistical activities were expanded to meet the needs arising from the decentralization and management programs of the Bureau. Reporting systems were instituted and standards were established to yield data necessary for the effective direction of the decentralized activities of the Bureau. Research was done on the various phases of the Bureau's work for use in administration, reorganization, budget presentation, public relations, legislative proposals, technical publication, and related functions.

Many requests for assistance were made by the Department of Justice in connection with the adjudication of claims before the Indian Claims Commission and the United States Court of Claims, claims which run into many millions of dollars. Considerable data were provided the Congress, both for congressional committees and individual Congressmen. These requests covered a vast variety of subjects in the fields of public-land management and disposal and the economics of land administration, and included area and status of public lands in the United States and Alaska; Bureau activities, by functions, units, and areas; disposal of public lands and resources; receipts and expenditures; public-land policies; timber and range management; leases, permits, and other non-Federal use of Federal ands; intergovernmental land-use relations; conservation of lands and resources; history of the public lands; geography; land grants; classiication of the public lands; public-land laws and regulations; Bureau programs; valuation of public lands and improvements; public-and terminology; and other matters. The first edition of a glossary of public-land terms and a paper on the increase in Federal land ownership, 1937–45, were ready for publication by the end of the year.

Despite the substantial progress made by the Bureau during the year in planning and programing the conservation and use of the public domain and its resources, the main job still lies ahead. Of prime mportance is the inventory of all the public domain to determine its exact location and character, to reveal the problems raised by its use and misuse, and to guide the management program toward better utilization of the lands. A forward-looking land-management program must, furthermore, include revision of obsolete laws, continuing mprovement of operations and the development of a conservation program geared to both regional and national needs.

Fish and Wildlife Service

Albert M. Day, *Director*

This report is a record of the year's accomplishments in the field of wildlife conservation. In its 30-odd pages it can do little more than suggest the many and varied activities by which the Fish and Wildlife Service, often in direct cooperation with the States or with private conservation agencies, seeks to conserve this resource.

From year to year, the Service's program is modified and adjusted as changing conditions affect the wildlife resources. This is inevitable and desirable, for wildlife is probably the least static of all our natural resources. Our conservation aims and the methods of attaining them must be ever sensitive to these changes and constantly improved in accordance with new demands.

Over the world as a whole, there is probably a keener interest in the development of marine resources than ever before. This is manifested in various ways: in closer coordination of scientific research as the basis of conservation, in exploration of distant, virtually unknown fishing grounds, and in expansion of fleets and invention of wholly new methods of fishing. Awareness of the immense potentialities of the sea has led the United States to organize programs of investigation in the central Pacific and in the waters of Bering Sea, while marine research in our North Atlantic waters is being carried on to an extent greater than ever before possible.

The passing years see more, rather than fewer, persons turning to the outdoors, and especially to wildlife, for recreation. To meet these needs, the Service is strengthening its programs for improving land as wildlife habitat, maintaining refuges for wildlife, and replenishing streams and lakes through artificial propagation of fish. Some of the most pressing problems of the moment are the result of increasing development of the Nation's river basins. These projects, as proposed or in actual operation, modify radically the habitat of many of our migratory fishes, of waterfowl and other birds, of some large game animals and of many small fur-bearing mammals of the river bottom lands. The Service is devoting the greatest possible energy and ingenuity to the satisfactory solution of the problems presented.

In the following pages, the activities of the Service are described under broad topics which in general correspond to its administrative branches; all, however, possess an underlying unity in that they are directed to preserving and increasing the wildlife resources and the conditions needed to maintain them.

RESEARCH IN WILDLIFE MANAGEMENT

Although the total wintering waterfowl population of the continent changed but little from the previous year, there was an increase in game ducks and geese, the January 1949 inventory of wintering waterfowl indicated. Canada, Mexico, Guatemala, Cuba, Haiti, the Dominican Republic, Puerto Rico, Jamaica, and the Bahama Islands cooperated in carrying out this inventory. Dominion and Provincial personnel conducted the winter inventories in Canada, and the Service sent flyway biologists to the countries south of us. The most complete coverage to date by Service personnel was made possible by the expansion of the flyway biologist staff from 4 to 11 members. These men are stationed in the four flyways and are responsible for obtaining data required for Federal waterfowl management and conservation.

The annual cooperative appraisal of conditions prevailing on the breeding grounds of northern United States and of Canada was made again in the summer of 1949. The Fish and Wildlife Service pooled manpower and equipment with the Dominion Wildlife Service and the Provincial game branches of British Columbia, Alberta, Saskatchewan, Manitoba, Quebec, and New Brunswick to obtain waterfowl-breeding information. The status of breeding waterfowl was generally favorable, with the number of most species higher than last year except in Oregon, portions of Montana, and the short-grass regions of Alberta and Saskatchewan, where serious drought conditions prevailed throughout the breeding season.

Additional information concerning American birds became available through the expanding cooperator program. Cooperating observers and participating clubs actively reporting on bird distribution and migration increased 40 percent this year. Approximately 287,000 birds were banded in the 10-month period ending April 30, 1949, for an increase of 52,000 over the previous year. There were 16,855 returns and recoveries as compared with 14,535 in 1948. Data from these files were utilized in preparing the revised ranges of North American birds for the A. O. U. checklist and Bent's important life histories, as well as by many research workers.

To work out methods of wildlife management compatible with sound agricultural practices, research continued on the two demonstration farms at the Patuxent Research Refuge, Md., one exhibiting modern agricultural methods; the other outmoded, but much used, practices. Experimenting with various species of shrubs, workers found that bicolor lespedeza, multiflora rose, silky cornel, and autumn eleagnus survive well in this region and are easily handled by the average farmer. Their principal uses are for woodlot border, contour hedges, wildlife cover plantings, and, in the case of the rose, living fences. Heavy mulching and fertilization have greatly increased the growth and vigor of plantings.

In Alabama a 2-year study has shown consistently higher populations of quail on farms operated under a modern land-use program than on farms where good soil-building and cropping practices were not employed. Preliminary work on the use of multiflora rose in the southeast indicates that on abandoned fields the shrub is spread by birds and drainageways. Whether it will prove to be seriously objectionable on this score is not yet certain. These 2 years of study have emphasized the regional limitations of wildlife management practices and the necessity for proving individual measures under varying agricultural conditions before they are recommended.

Public interest in the hazards to fish and wildlife of DDT and other insecticides was greater this year than at any time since the release of DDT to the public in 1945. Part of the apprehension over control activities with DDT probably can be attributed to public announcements by the Food and Drug Administration concerning the hazards to humans of DDT used around livestock and on certain agricultural commodities. The heightened interest was reflected in a marked increase in the number of requests for general information and for guidance in control operations. Evidence of a more conservative viewpoint was expressed by State fish and game agencies, and at least one State (Connecticut) now requires the prior approval of their fish and game department for aerial dispersal of insecticides.

Entomological research in the past year has demonstrated clearly that some insects have acquired resistance to DDT, and in some cases control efforts by established procedures have been noticeably ineffective against these resistant strains. Increased dosages of DDT and the substitution of other new insecticides will be logical adjustments in some control programs. Both of these trends will demand increased vigilance and investigation if pest-insect control is to be consistent with fish and wildlife interests. As in previous years, every effort was made to keep entomologists, control operators, and others informed of findings in this program. This was accomplished through summary presentations before national biological societies, prompt publication of results in professional journals, and a widespread distribution of reprinted literature.

A grasshopper-control program in Montana and Wyoming involving the treatment of 50,000 acres of range land with chlorinated camphene (Toxaphene) was studied for effects of the toxicant on birds, mammals, and other wildlife. Additional studies were continued in Maryland on the wildlife effects of DDT used in codling-moth control in apple orchards and in the control of Japanese beetles and other insect pests on corn. Follow-up studies were initiated in Princeton, N. J., to determine the nature and extent of bird mortality resulting from control of bark beetles with DDT, which at present is the only known means for saving valuable elm trees from the Dutch-elm disease. A heavy loss of birds and other wildlife has resulted from the treatment, and at present studies will attempt to reveal means of minimizing or eliminating these losses. The Service is cooperating with the State of New Jersey and the Bureau of Entomology and Plant Quarantine in studies to determine the hazards to fish and wildlife from salt-marsh mosquito control with DDT in coastal New Jersey. Mosquito-abatement programs are rapidly gaining in public popularity, and the New Jersey findings will have general application to Nation-wide conditions.

The past year also witnessed a marked increase in vegetation-control programs using new chemical herbicides. In Iowa alone, more than 20 million acres of cornland were treated with 2,4-D for weed control. Since weed seeds constitute an important, and frequently the sole source of foods for songbirds and important gallinaceous game birds, this rapidly expanding substitute for cultivation requires careful appraisal. Herbicides have found wide application for the elimination of wildlife cover plants along roadsides, fencerows, and rights-of-way. Indiscriminate use of these highly effective agents may well present further complications to programs endeavoring to provide increased game crops. The chemical control of pest plants has resulted also in serious kills of fish and marked modifications of aquatic habitats. Studies will be broadened as rapidly as possible to provide information on how and where such programs can operate with a minimum of harmful effects.

Studies at the Denver Wildlife Research Laboratory of a promising new rodenticide, an anticoagulant known as compound No. 42, have indicated that the chemical may have potential value as it can be used in minute quantities with repeated doses. Its use may lessen the hazards of accidental ingestion of exposed baits used in rat control Several other new rodenticides, of possible assistance to orchardists in combating tree-girdling field rodents, are also being tested.

Definite progress also has been made in the field of repellents for mammals. Under a grant from the Quartermaster Corps, approximately 100 candidate materials were evaluated as repellents against rats when applied to materials for packaged goods supplied the Service by commercial firms in the newly developed "rattery" established a the Federal center west of Denver. Results of the tests have been encouraging. Studies with repellents for deer disclosed two promising materials which have proved of value when employed during spring and summer, when a choice of food usually is available.

The 14 cooperative wildlife research units, maintained by the State game departments, land-grant colleges, the Wildlife Management Institute, and the Fish and Wildlife Service, continued their active research and training programs during the year. Located in Alabama, Colorado, Idaho, Iowa, Maine, Massachusetts, Missouri, Ohio, Oklahoma, Oregon, Pennsylvania, Texas, Utah, and Virginia, their research projects totaled approximately 150, including investigations on a variety of small- and big-game species, waterfowl, predators, fur animals, land use-wildlife relationships, control methods, and many other phases of wildlife management. Numerous technical and popular articles were published by unit personnel, and research findings were used by State, Federal, and private conservation agencies. Approximately 70 men, technically trained in this program, were employed by State game departments, colleges, and Federal agencies during the past year.

Investigations were continued during the year by Service personnel on national forests, national parks, and Indian reservations under cooperative agreements with the various Federal agencies concerned. These studies provide the information necessary to improve the management of wildlife on the 200 million acres of public lands.

The work on national forests has centered around the effects of small mammals in preventing reforestation, the results of deer browsing on ponderosa pine, a study of porcupine cycles in the northern Rocky Mountains, an evaluation of the wildlife carrying capacity of the longleaf-pine type, a deeryard survey in Minnesota, and a continuation of the cooperative big game-livestock range resources study in Utah.

In cooperation with the Bureau of Indian Affairs, a beaver survey was made of the Fort Apache Reservation, and an Indian boy was trained to handle beaver management. With aid from the University of Minnesota, assistance was given in managing the Red Lakes commercial fishery. The Service also cooperated in the preparation of a wildlife primer for use in Indian schools.

Projects in national parks included an annual evaluation of moose-food conditions on Isle Royale, Michigan, a survey of the winter deer range (Zion, Utah), and a study of the possibilities of transmission of hoof-and-mouth disease across the Mexican border by migrating big game (Oregon Pipe Cactus, Ariz.).

An abstract of State fur laws, containing valuable information for trappers, legislators, fur tradesmen, and publishers, has been published by the Service since 1915. The Service has also published a report on the annual fur take of the United States since 1939, an innovation which has encouraged the various States to collect such information. Whereas but 12 States kept such records in 1934, at the present time 45 are recording their annual take of fur animals. Fur-animal-management investigations were continued on the Federal refuges in which impoundment and land-management practices were studied toward maintaining and improving the habitat for muskrat, raccoon, nutria, beaver, mink, and other fur animals; also fur production and grazing, and competition between fur animals and waterfowl were studied and analyses made. At the Patuxent Research Refuge, Md., research continued to determine the fur productivity of submarginal farm lands along the western border of the Atlantic coastal plain. This work has demonstrated that part-time trapping or hunting 2 or 3 months a year on depleted land can be made to yield about 40 cents an acre in wild furs as a side line to farming and timber-growing operations.

THE NATIONAL WILDLIFE REFUGE PROGRAM

The slight but encouraging increase in the continental population of migratory waterfowl in 1948 was due to a successful nesting season in the Dakotas, Montana, parts of Canada and Alaska, coupled with the stringent hunting regulations of the past 2 years. Safeguarding a nucleus of these birds during their southward flight and on their southern wintering grounds is a major function of the national wildlife refuge system. Although there were several critical spots, with concentrations of birds far in excess of needed local natural food supplies, few flocks required special feeding or dispersal. In general, the population of birds returning northward to breed in the spring of 1949 was encouraging, although the number was too low for the proper utilization of existing breeding grounds.

The local convergences of birds in the Pacific Flyway, with the few existing refuges already overcrowded, and other natural habitat disappearing at an accelerated rate, present the most urgent problems of management.

During fall migrations, locally hatched ducks and geese and those from Alaska, British Columbia, and Alberta rest and feed on the Turnbull National Wildlife Refuge, Wash., and the Deer Flat, Minnidoka, and Camas National Wildlife Refuges in Idaho, before moving southwestward to the 175,000-acre Malheur National Wildlife Refuge in southeast Oregon. On practically all of these refuges, supplemental food supplies, in the form of cultivated grains, are grown through cooperative farming practices, the Government's share being left standing for the birds. In some instances, where even a greater food supply is necessary because of extreme concentrations, farming is done by refuge personnel in order that all the grain may be left. Both methods of farming are used on Malheur Refuge, while on the newly established 205,000-acre Stillwater wildlife management area near Fallon, Nev., the region next visited by many of these birds, farming will be done by refuge personnel. Part of the waterfowl flight moves southwestward to the Tule Lake and Lower Klamath National Wildlife Refuges—on the Oregon-California line—where the coastal flight from Alaska, British Columbia, and Puget Sound also assembles to rest and feed. It has been estimated that more than a third of the Pacific coast waterfowl use the Klamath Basin Refuges during some part of the fall migration. Later in the season most of these birds, together with some from the Stillwater area, converge on the Sacramento National Wildlife Refuge in the Sacramento Valley of California. The cultivation of rice on the latter area and other grains on the nearby Sutter and Colusa National Wildlife Refuges has been necessary, as the huge concentrations of geese and ducks have been arriving early in recent years, driven south by hunting pressure before the privately grown rice had been harvested.

The production of rice is expensive but absolutely necessary to prevent damage to privately owned ricefields, the acreage of which has increased greatly in the Sacramento Valley in the past 10 years. On the 37,000-acre Tule Lake Refuge, barley is raised on irrigated lands adjacent to the 14,000-acre sump as a buffer against bird damage in the extremely productive grainfields surrounding the refuge, and to hold the birds in that area an extra month.

In the Central Valley of California, waterfowl marshes have all but disappeared. Opportunities for refuge acquisition and development are limited by high land costs and already appropriated water supplies. Nevertheless, this Service and the California Fish and Game Commission, by agreement and through special appropriations for the purpose, are continuing to secure and develop suitable areas both for refuges and public hunting purposes in the area.

Lands surrounding Puget Sound in Washington present equally difficult problems for waterfowl protection and management. In this region of natural waterfowl concentrations, truck gardening has increased while marshes for ducks and geese have proportionately diminished, and efforts to provide wildlife refuges to hold the birds and avoid crop damage have met with no success.

Similar problems of bird concentrations are being handled by intensified food production on refuges located in North and South Dakota, Illinois, Missouri, Oklahoma, Arkansas, and North Carolina.

Experimentation by the Service in marsh management during the past few years is not only producing results but serves as a model for similar operations by other Federal agencies, State game commissions, and private landowners. Controlled burning, limited cattle grazing, and disking of marshes at the right season of the year provide attractive grazing conditions for geese along the Gulf and the Atlantic coasts. Manipulation of water levels, burning, and cultivation have been used to control maiden-cane, sawgrass, cattails, willows, and other obnoxious vegetation on areas such as the Savannah National Wildlife Refuge, Ga.; Cape Romain National Wildlife Refuge, S. C.; St. Marks National Wildlife Refuge, Fla.; Mattamuskeet National Wildlife Refuge, N. C.; Reelfoot National Wildlife Refuge, Tenn.; Bitter Lakes National Wildlife Refuge and Bosque del Apache National Wildlife Refuge, both in New Mexico. When these operations can be followed by restoration of water levels and the introduction of desirable, food-producing plants, many acres of excellent waterfowl marsh are restored.

Another management technique employed in the control of pest plants has been the application of chemicals, as 2,4-D and 2,5-T, together with appropriate manipulation of water levels and replacement with desirable plant species. A Service-owned plane, fitted with spray equipment, is used full time in this work.

The prevention and control of fires on the 18 million acres of refuge lands in 1948 was very encouraging, the number of fires during the year representing a 200 percent decrease from the previous 6-year average. The acquisition of more useful equipment, including radio-controlled jeep fire-fighting units, has proved worth while.

The Service has been actively participating in the departmental soil and moisture program since 1941 and is currently administering 16 projects. A total of 95,000 acres of land has been directly affected and materially benefited with an expenditure of $436,300 over a 9-year period. The acquisition of land for wildlife purposes is frequently possible only because the land is of low cost, is nonproductive, or otherwise of little value. Thus, wildlife management and restoration have a direct relation to erosion control. The problem of the management of severely depleted and eroded lands on the refuges is a staggering one. It has been estimated that more than a million acres require moderate to intensive treatment, and it is essential to accelerate the present rate of restoration to cope with the situation. Primary efforts in the past have included the use of diversions, check dams, and other methods of control to heal the scars of erosion. Excellent examples of these on Federal refuges are to be seen on the Piedmont Refuge, Ga.; Kentucky Refuge, Ky.; and the Tishomingo Refuge, Okla. Direct benefits to big game, livestock, and the general improvement of range conditions have resulted from water-hole and spring developments on the Kofa and Cabeza Game Ranges, Ariz.; and the Desert Game Range and the Sheldon National Antelope Refuge, Nev. An allotment of $95,000 for fiscal year 1949 permitted expansion of the work. Development of comprehensive soil and moisture plans of operation for all refuges is under way as a means to better land utilization.

Weather and water conditions, important factors in waterfowl nesting and food production, were favorable over much of the country in 1948 and 1949. Unusually deep snows during the winter 1948–49 in Nebraska, parts of the Dakotas, Idaho, and Nevada, did little damage to water-control structures, but extensive damages resulted to fences and trails by the bulldozing of highways. These losses were more than offset, however, by the many acts of mercy by refuge personnel in aiding snow-bound persons and livestock. Refuge families were among those isolated. Roads to the Lostwood National Wildlife Refuge, N. Dak., were blocked from December 14, 1948, to February 25, 1949. Mail and supplies were dropped by plane. Wildlife losses were not severe except on pheasants through the Dakotas. On the Lacreek Wildlife Refuge, in southwestern South Dakota, where storms were the worst in 60 years, the loss of pheasants was estimated at from 60 to 90 percent.

The response of wildlife to favorable conditions on refuges is reflected in higher waterfowl production, as well as the encouragement of other species. Big game, particularly deer, has increased in numbers in all parts of the country. Live trapping of deer by State conservation departments for restocking depleted woodlands has been encouraged. On the 4,800-acre Blackbeard National Wildlife Refuge, an island off the Georgia coast, 66 deer were trapped and removed by the Georgia Game and Fish Commission with the loss of only 2 animals—an outstandingly successful operation.

The 1948 fall flight of geese was widespread, and these birds made far greater use of refuges through the Mississippi Valley than previously. Canada geese formerly concentrated around the small Horseshoe Lake State Refuge in southern Illinois, where they were subjected to intensive hunting; now the birds are attracted in much greater numbers to the various Federal refuges surrounding Horseshoe Lake—in Missouri, Arkansas, Tennessee, Kentucky, and Illinois. Blue and snow geese also rested and fed on many of these refuges for several weeks; normally their southward flight from Hudson Bay to the Gulf coast is completed with but few stops en route. The increased wintering of geese was particularly noticeable on the 44,000-acre Crab Orchard National Wildlife Refuge, about 50 miles northeast of Horseshoe Lake. Peak population of Canada geese during the winter of 1947–48 was 2,200 birds, while the January 1949 inventory disclosed 29,000 birds, with a peak of 45,000 during March 1949.

Greater emphasis on the production of cultivated foods for wildlife was continued in 1948, resulting in the farming of 47,182 acres of refuge lands by private individuals and refuge personnel, producing 1,008,558 bushels of grain as well as green forage crops. Other economic uses not inconsistent with proper wildlife management of the refuges were encouraged. A total of 334,321 animal-use months of grazing was permitted on 980,029 acres of grasslands, principally after the waterfowl and upland game-nesting season. In addition, 15,253 tons of hay were harvested on these areas. More than 2,100 individuals participated, under special-use permit, in the economic-use program.

TABLE 1.—*Number of animals on fenced big-game areas maintained by the Fish and Wildlife Service*

ANIMALS AS OF JUNE 30, 1949

Refuge	Buffalo	Elk	Deer		Texas longhorn	Total
			White tailed	Mule		
National Bison Range, Mont.[1]	608	92	64	427		1,191
Fort Niobrara National Wildlife Refuge, Nebr.	214	61			120	395
Sullys Hill National Game Preserve, N. Dak.	19	20	30			69
Wichita Mountains Wildlife Refuge, Okla.[2]	693	296	776		284	2,049
Total	1,534	469	870	427	404	3,704

YOUNG BORN IN CALENDAR YEAR 1948

Refuge	Buffalo	Elk	White tailed	Mule	Texas longhorn	Total
National Bison Range, Mont.	170	[3] 35	[3] 18	[3] 150		373
Fort Niobrara National Wildlife Refuge, Nebr.	45	15			26	86
Sullys Hill National Game Preserve, N. Dak.	5	6	10			21
Wichita Mountains Wildlife Refuge, Okla.	92	25	100		59	276
Total	312	81	128	150	85	756

[1] No record of young produced by 12 mountain sheep.
[2] The 40 antelope on the Wichita Refuge had 3 young.
[3] Estimated.

The sale of timber products in 1948 was on about the same scale as the year previous. It included removal of 4,654,200 board feet of saw logs, 11,049 cords of pulpwood, and 10,316 ties and posts.

Total revenue for this fiscal year from all economic uses on the national wildlife refuges, including the disposition of big-game animals, and surplus products, was $343,130. By law, 25 percent of this revenue was paid to the counties in which the refuges are situated, and the balance was deposited in the Treasury of the United States. The slight decrease in total revenue is due to the smaller sale of furs, which normally is the major item, and of which the muskrat constitutes well over 75 percent. Drought conditions on the Louisiana coast, and the unusually high saline content of waters on Maryland refuges reduced muskrat populations and trapping opportunities.

The 205,000-acre Stillwater Wildlife Management Area, located in Churchill County, Nev., was activated early in 1949, through an agreement reached with the Truckee-Carson irrigation district, Nevada Fish and Game Commission, and this Service. Intensive development of 20,000 acres was begun, whereby waste irrigation waters will be reclaimed for waterfowl purposes. These waters, which were formerly dissipated thinly on Carson Sink, now will provide an excellent refuge of sufficient size to permit some public hunting which will be managed by the State.

Alaska is today the great unknown in our continental waterfowl management. Investigations to date, however, reveal that it has great significance in the waterfowl supply of the Pacific Flyway and probably contributes also to the Mississippi and Central Flyways. Banding returns indicate that approximately 80 percent of the Pacific Flyway birds are bred in Alaska.

TABLE 2.—*Acreage acquired or in process of acquisition for national wildlife refuges under the Migratory Bird Conservation Act and by exchange and act of Congress, fiscal year 1949*

State	Refuge	Acquired other than by purchase	Purchased under Migratory Bird Conservation Act	Total acquired	Pending title conveyance
California	Colusa				1,091
	Sutter		1	1	
Florida	St. Marks	56		56	
Georgia	Okefenokee				1,855
Iowa	Union Slough	1	87	88	99
Kentucky	Kentucky Woodlands		173	173	105
Maine	Moosehorn		14	14	176
Missouri	Mingo		1,510	1,510	2,751
Nebraska	Valentine				224
New Jersey	Brigantine				789
New Mexico	Bosque del Apache				963
New York	Wertheim				23
North Carolina	Mattamuskeet				16
North Dakota	Des Lacs		6	6	
	Lake Ilo		40	40	
	Long Lake		52	52	
	Lostwood				80
	Lower Souris				7
	Upper Souris				34
Oregon	Cold Springs		133	133	
	Malheur	513		513	5,209
Texas	Laguna Atascosa	[1] 8,486		8,486	18,997
Vermont	Mississippi		118	118	128
Virginia	Chincoteague		5	5	154
Washington	Turnbull		888	888	459
	Skagit				2,351
	Willapa		3,058	3,058	21
Wisconsin	Horicon		1,212	1,212	1,269
	Necedah				80
Total		9,056	7,297	16,353	36,881

[1] Transferred to the Fish and Wildlife Service under authority of the act of May 19, 1948.

During the fiscal year 1948, the refuges in Alaska were brought under active administration; trained personnel were assigned and additional equipment was supplied for their investigations and protection of the areas. It is most important that several additional large-scale waterfowl-nesting grounds be established. These areas have importance in the economic development of the country and cannot be made inviolate refuges; they can, however, be set aside as waterfowl-management areas under conditions which will protect their waterfowl value, yet permit grazing, fur harvesting, some types of hunting, and other activities important to the citizens of Alaska.

FEDERAL AID TO STATE PROJECTS FOR THE PROTECTION OF WILDLIFE

With an appropriation of $11,276,687.37, the largest to date, to finance the Federal Aid in Wildlife Restoration Program, the Service approved a record total of 612 projects submitted by the 48 States, Alaska, Hawaii, Puerto Rico, and the Virgin Islands under the provisions of the Pittman-Robertson Act of 1938. These projects obligated $8,894,844.33, with the remainder of the year's funds being carried over to finance wildlife-restoration work during fiscal year 1950, as provided by law. By the end of the year, 13 States had obligated all or nearly all of their apportioned Pittman-Robertson funds. Net obligations, by activities, during this 12-months' period were as follows: developmental measures, $4,368,754.97 (49 percent); land acquisition, $2,036,600.01 (23 percent); surveys and investigations, $1,720,883.04 (19 percent); wildlife-management coordination, $521,173.42 (6 percent); and maintenance of completed projects, $247,432.89 (3 percent).

American farmers continue the intensive exploitation of the soil begun during the early years of the war, and State game administrators have been employing Pittman-Robertson funds to acquire the few remaining wildlife habitats in their States and thus prevent their destruction by the encroachment of agriculture. Thirty-five States bought wildlife lands in 76 areas during the year, totaling approximately 163,000 acres, and, in addition, 9 States leased almost 115,500 acres. High prices and the reluctance to sell even low-grade lands brought the cost up to $15.40 an acre as compared to $11.44 in 1948.

In keeping with efforts to stem the continental decline in waterfowl populations almost half of the acquisition projects selected were primarily for ducks and geese. Arkansas led with a purchase of 21,155 acres of swamp and flood plain in the Bayou Meto Unit, located in the famous Stuttgart waterfowl concentration area. Eventually, 37,500 acres will be acquired and developed there as a combined refuge and public shooting ground. Other States making large purchases for the management of waterfowl populations included Indiana, Rhode Island, Nebraska, Maryland, and Illinois.

The western States have continued to emphasize the acquisition of big-game ranges. The largest single purchase of the year was that by Texas of 35,500 acres in the Big Bend country. Eventually to contain 250,000 acres, Texas' Maravillas wildlife area will provide well for the deer, antelope, and scaled quail within its confines. Montana purchased 11,000 acres in the Blackfoot-Clearwater country and leased an adjoining 43,000 acres for its deer and elk, thereby providing needed winter range. Oklahoma, Washington, California, Wyoming, Arizona, and Utah added to previously acquired big-game lands. Florida purchased 14,500 acres and leased 28,260 acres in Palm Beach County to establish a management area for quail, turkey, and deer. Similar actions by Mississippi and Georgia will benefit upland game species in those States. Michigan, Minnesota, Utah, and Wyoming also bought lands for upland game this year.

More than 75 percent of the Nation's wildlife is produced on agricultural land. To guarantee its continued production in this era of mechanized and intensive agriculture, 35 States secured leases and easements on private lands and ranches during the year. With the cooperation of landowners, Soil Conservation districts, 4–H Clubs, and sportsmen's groups, these refuges for wildlife were planted to desirable trees, shrubs, and cover plants, fenced against livestock, and water catchments constructed in arid places. Added benefits of such restoration will be the abatement of soil erosion and improvement of the soil. Several million bicolor lespedeza seedlings and thousands of pounds of bicolor and sericea lespedeza seeds were distributed to farm cooperators by 8 southeastern States. New York planted 5½ million trees and shrubs, and Missouri provided landowners with enough multiflora rose to plant 640 miles of living fence, leading the way with 100 miles of demonstrational plantings. Thirteen States made habitat improvements for the benefit primarily of quail, rabbit, squirrel, and pheasant. Michigan, for example, created planned habitat on more than 500 acres in 11 State game-management areas, planting a half million trees and shrubs.

Development of habitat favorable to ducks and geese, and indirectly beneficial to muskrats and upland game, was undertaken by 29 States during the year. Kansas began the impoundment of 15,000 acres in the Cheyenne Bottoms which will lead to the creation of a major waterfowl area in the Central Flyway. Although hindered by high land prices and with public shooting largely limited to private duck-club holdings, Iowa is developing such marshes for ducks and geese as are still available.

To extend the ranges of certain game species that are restricted by natural barriers, to stock-depleted ranges, and to distribute more equitably concentrated populations of animals, 30 States and Hawaii trapped and transported several hundreds of game animals. These include 1,729 antelope, 1,485 beaver, 2,894 deer, 282 muskrat, 255 raccoon, 1,010 wild turkey, as well as substantial numbers of grouse, pheasant, quail, rabbit, bighorn sheep, Chukar partridge, and marten.

Outstanding among recent events has been the united action by neighboring States in their approach to common wildlife problems. States in the Pacific Flyway, with British Columbia and Alaska, have banded together to work out uniform techniques and programs for improved waterfowl management. The northeastern States concentrated on black duck and woodcock investigations. Ten southeastern States made a study of mourning dove migrations and reproduction in their search for better management methods. Four western States arranged a simultaneous census of interstate antelope herds and counts were made of antelope by Montana and Saskatchewan, and of deer by North Dakota and Manitoba, jointly.

Evaluation of food and cover conditions, surveys of range-carrying capacities, and population estimates resulting from State-wide surveys financed by Pittman-Robertson funds have formed the basis in many instances for determining the length of the State hunting season and limits on nonmigratory and big-game species. Where population adjustments were found necessary recommendations were made. Colorado, following up such a recommendation, is now permitting the taking of two deer on certain problem areas where formerly one buck was allowed.

MAINTAINING THE INLAND FISHERIES

The tremendous increase in tourist travel to our national playgrounds and longer vacations for many people have resulted in extraordinary growth of angling as a recreation. The number of licensed anglers has more than doubled within the decade and now totals about 15 million. The resulting demand for good fishing waters with abundant supplies of game fish has taxed the resources of State and Federal Governments to produce enough fish in their hatcheries to maintain adequate stocking programs. And in addition to stocking streams and lakes, fish must be provided for the great numbers of farm ponds that are being constructed in many sections of the Nation as awareness of the need for soil- and water-conservation spreads.

Production of most of the desirable species was maintained at a high level in Federal hatcheries during the past year, and rehabilitation was begun at many of the units that had been adversely affected by curtailed appropriations and inadequate manpower during and since the war. This production was achieved in spite of many obstacles: excessive flood damage to fish-culture units in the Columbia River Basin and other parts of the country which reduced production in those areas; blizzards which hampered operations at many of the units throughout the west; and increased costs of labor, material, and supplies which curtailed production at many stations.

Special allotments were received for replacement and repair of existing structures and fish-rearing facilities at Lamar, Pa.; Nashua, N. H.; Hagerman, Idaho; San Marcos, Tex.; and Hot Springs, N. Mex.; for new construction of a trout unit at McNenny, S. Dak., a substation of the hatchery at Spearfish, S. Dak., and for the completion of the warm-water fish hatchery at Farlington, Kans. These special allotments were supplemented by $150,000 for the rehabilitation of other stations.

The tremendous increase in the number of trout fishermen has caused increased demands for the stocking of legal-sized fish, a procedure which experience in the Pisgah National Forest and other management areas has proved worth while. However, many of the trout stations need extensive alterations and additions of rearing facilities to meet the demands for larger fish. These alterations and additions are being made as funds become available. The continued high cost of fish food has emphasized the need for further studies on nutrition. Also, the many problems resulting from the rearing of larger trout for stocking purposes has necessitated the perfection of new and improved methods of trout culture, including the experimental use of many new chemicals, such as sulfamerazine, which has proved to be outstanding in the control of ulcer disease.

During the past fiscal year, an in-Service training program for fish-culturists was initiated at the station at Leavenworth, Wash., where adequate facilities and personnel are available. Particular emphasis is given to proved methods of raising trout and salmon and to the efficient management of fish-cultural stations.

Farm owners have become increasingly conscious that proper conservation measures build up the value of their land, and have become correspondingly interested in the construction of farm ponds. To aid the farm-pond program, the Service instructs pond owners in a sound program of fish management, inspects large numbers of farm ponds for corrective stocking, and is improving its facilities for the production of warm-water fish. Although a number of stations increased production by improving pond management, by limiting the size of fish produced, and by modernizing techniques employed, further increases in the production of warm-water fish will depend upon modernization of existing stations and the construction of new units. Experimental work is being conducted to improve the efficiency of warm-water stations and to provide information on the correct stocking and management practice for farm ponds.

Hatchery production of marine species was curtailed during the year. This curtailment resulted in an over-all reduction (as compared with the production in 1947) in the total number of eggs, fry, and fingerlings distributed. The production of salmon, trout, and warm-water fish, however, was maintained at approximately the same high level recorded in 1947.

The fresh-water mussel propagation program was continued with headquarters at Crab Orchard National Wildlife Refuge, Cartersville, Ill. Operations were carried on in several States. The cooperation received from the various State conservation departments and the officials of the Button Manufacturers' Association has been gratifying. The results of these mussel-propagation activities are expected to be of major importance to the fishing industry in a few years.

The following tabulation is a summary of the production of Federal hatcheries for the calendar year 1948:

TABLE 3.—*Summary of the production of fishes and eggs by Federal hatcheries during the year ended December 31 1948*

Group	Eggs	Fry	Fingerling	6 inches or longer	Total
Catfish			832, 885	9, 985	842, 870
Channel catfish		160, 500	275, 370	165	436, 035
Yellow catfish			6. 650	50	6, 700
Buffalofish	168, 000, 000		12, 300		168, 012, 300
Shad		5, 414, 000			5, 414, 000
Atlantic salmon	5, 000		87, 035	92, 445	184, 480
Chinook salmon	11, 233, 000	21, 076, 660	17, 391, 400		49, 701, 060
Chum salmon	704, 650	9, 058, 115			9, 762, 765
Silver salmon	10, 140		603, 620		613, 760
Sockeye salmon	625, 150		2, 804, 735	97, 000	3, 526, 885
Landlocked salmon				15, 975	15, 975
Steelhead trout			204, 800		204, 800
Rainbow trout	9, 601, 580		7, 353, 980	901, 100	17, 856, 660
Cutthroat trout	16, 267, 800	1, 379, 840	2, 085, 075	6, 290	19, 739, 005
Brown trout	2, 147, 990		1, 694, 575	134, 995	3, 977, 560
Lake trout			313, 295		313, 295
Brook trout	13, 143, 820	304, 000	3, 451, 845	549, 415	17, 449, 080
Grayling	4, 055, 130		2, 000		4, 057, 130
Walleyed pike		5, 780, 000	800		5, 780, 800
Northern pike	2, 910, 000	6, 270, 000		100	9, 180, 100
White crappie			35, 275	230	35, 505
Black crappie			151, 955	1, 380	153, 335
Largemouth black bass		1, 287, 390	6, 842, 455	13, 625	8, 143, 470
Smallmouth black bass		1, 160, 000	176, 940	1, 145	1, 338, 085
Rock bass			1, 890		1, 890
Warmouth bass			130		130
White bass			45	145	190
Bluegill			33, 367, 750	3, 410	33, 371, 160
Green sunfish			76, 600	445	77, 045
Red-eared sunfish			22, 500	660	23, 160
Yellow perch			70, 185	185	70, 370
Flounder		600, 400, 000			600, 400, 000
Pollock	801, 190, 000				801, 190, 000
Lobster		1, 345, 200			1, 345, 200
Terrapin				1, 300	1, 300
Total	1, 029, 894, 260	653, 635, 705	77, 866, 090	1, 830, 045	1, 763, 226, 100

SALMON CONSERVATION IN THE UNITED STATES

The sum of $973,000 was transferred by the Army Engineers to the Fish and Wildlife Service for fisheries development on the lower Columbia River. This development program was begun during the year, and additional funds will probably be made available for further development of the project during the coming years. In the Columbia River, as in the Sacramento, the erection of multiple-purpose dams has frequently had an unfavorable effect upon migratory fishes, of which the salmon are of chief importance. The maintenance of these valuable runs is dependent upon both natural and artificial propagation. Dams already constructed cut off a large percentage of the areas most suitable for natural spawning, and dams proposed for future construction will further reduce the areas now available; thus artificial propagation of the runs assumes increased importance.

On the Columbia River the salmon fishery is currently valued at 17.5 million dollars. Following the construction of Grand Coulee Dam, the Service undertook to preserve the upper-river salmon runs by transplanting them to streams that entered the Columbia River below the dam. After a decade of artificial propagation this program has been adjudged to be a success. The return of adult blueback salmon to the Grand Coulee Project is at present considerably greater than the numbers that ascended the Columbia to that area before the construction of Grand Coulee Dam. The fishery interests of the States of Washington and Oregon recognize this success. Furthermore, the operations have resulted in an increase of spring chinook salmon ascending to the upper Columbia River. However, very few salmon seek to pass Grand Coulee Dam; instead, they turn into the tributaries or return to the hatchery streams where they were released as fingerlings.

McNary Dam (now under construction in the lower Columbia River) and other proposed dams may cancel, to a great extent, the success of the Grand Coulee stations. To continue a program for the preservation of the salmon runs in the Columbia River, the Service, in cooperation with the States of Washington and Oregon, has embarked upon a plan which involves, among other features, the rehabilitation and improvement of existing hatcheries on the lower river and the construction of new units. This program is essential for the production of fingerlings to assist in the maintenance of these runs.

At the lower Columbia River stations, artificial propagation of salmon has been continued for many years with marked success. During the past 3 years the take of fall chinook eggs has been exceptionally great as a result of successful operations at these stations during the previous cycles. At the Little White Salmon station a number of sockeye fingerlings imported from Alaska were released many years ago. During the 1948 season more than 200,000 eggs were taken from the returning adult sockeye salmon.

At the Quilcene, Wash., station the hatchery-built run of chum salmon has been increasing in size each year until now hatchery facilities are inadequate to handle the eggs that must be taken. At this unit, also, large numbers of trout are reared for the stocking of waters of Olympic National Park.

The construction of Shasta Dam across the Sacramento River in California presented a problem similar to that which has been met on the Columbia River. Here, as in most areas, reliance is placed upon both natural and artificial propagation, but emphasis is placed upon hatchery operations to maintain the important fishery of the Sacramento. This program, too, appears to have been successful. Reports for 1948 indicate that hatchery-reared salmon, upon their return to the river as adults, comprised 42 percent of the total catch of the commercial fishery in the San Francisco Bay area. Each year since 1942, the production of the Coleman hatchery has been increased to maintain this run. During each of the calendar years 1947 and 1948, about 100,000 pounds of fingerling chinook salmon were released.

Since some of the large new dams may make it desirable to pass fishways through dams, Fish and Wildlife Service biologists conducted an experiment at Bonneville Dam on the Columbia to see if salmon would readily pass through such a darkened area. It was found that little or no delay of the fish was occasioned. New experiments have been started in which the possible uses of chemical and temperature stimuli in conducting young fish safely past dams are being studied.

In the Central Valley of California biological work was continued to obtain information of value in protecting salmon at the large works of the Bureau of Reclamation in that area. Analysis of catches from a large number of fyke nets showed that most downstream migration of young salmon took place at night, with occasional daytime peaks during flood crests.

Progress was made toward rehabilitation of the runs of Atlantic salmon in the northeastern States. A number of streams were surveyed and areas capable of supporting new runs of Atlantic salmon found.

RIVER BASIN DEVELOPMENT AND WILDLIFE NEEDS

As multiple-purpose projects under the Federal programs of river-basin development increased in the United States during 1949, the Fish and Wildlife Service's Office of River Basin Studies not only conducted a greater number of investigative studies, but instituted an advanced type of survey covering wildlife habitat development.

During the fiscal year 1949, Service biologists and engineers completed 231 reports, of which 40 concerned projects in the Missouri River Basin. Of these 129 were made for the Corps of Engineers, 42 for the Bureau of Reclamation, 7 for the Soil Conservation Service, one for the Forest Service, one for the Department of Agriculture, one in cooperation with the Dominion of Canada, and 50 under the provision of section 18 of the Federal Water Power Act. In addition to these surveys were wildlife habitat development reports on Angostura (South Dakota), Baldhill (North Dakota), and Enders and Medicine Creek Reservoirs (both in Nebraska).

As a result of 4 years' work in the Missouri River Basin, the Service filed a detailed survey of current and future fish and wildlife resource problems of the area with the Water Resources Subcommittee, to be included in a comprehensive report on activities of Department of the Interior agencies in the Basin. Simultaneously, a memorandum of understanding between the Fish and Wildlife Service, the Bureau of Reclamation, and the State conservation departments was executed to foster maximum cooperative effort between the respective agencies in preserving and benefiting fish and wildlife resources of the Basin.

Increasing pressures on wildlife resources and the lands they utilize have emphasized the need for setting aside a larger number of acres where protection and propagation can be assured. Lands at Cascade Reservoir, Idaho, will be returned to the State as a wildlife management area. Grays Lake in the same State, one of the finest potential waterfowl areas in the northwest section of the United States, may be restored as a nesting area for waterfowl, and lands adjacent to the lake acquired to become a habitat for muskrats and other fur animals. The Bureau of Reclamation and the Bureau of Indian Affairs have agreed to a water exchange that will permit irrigation water from 55,000 acre-feet of space in Palisades Reservoir to replace water now being drawn from Grays Lake by the Fort Hall Indian Reservation. Final approval of this agreement, however, awaits action by Congress.

During the year negotiations were continued with the Corps of Engineers to set aside lands at Harlan County Reservoir in the Republican River Valley of Nebraska as a Federal waterfowl refuge and a State-managed hunting ground. Two other Nebraska reservoirs, Enders and Medicine Creek, which are expected to flood 1,715 and 1,900 acres, respectively, have been studied in cooperation with Nebraska wildlife officials to develop a plan for replacing wildlife food and cover which reservoir inundations will destroy. Wildlife plantings were also mapped out for Angostura Reservoir in South Dakota and at Fort Randall Reservoir in the same State development of winter habitat was undertaken.

Though the future water supply of the Grasslands, the celebrated 100,000-acre waterfowl wintering area in the Central Valley of California, is fraught with exceptional difficulties, the Fish and Wildlife Service cannot consider abandonment of the objectives here and continuing efforts will be made until these have been reached. Plans have been completed for a 1,000-acre planting program at Baldhill Reservoir in North Dakota to aid upland game and a 10,000-acre conservation preserve at Bluestone Reservoir in West Virginia. Impending inundation of hundreds of miles of bottomland on the Missouri River from the Nebraska line to the Montana boundary, when five reservoirs—Gavins Point, Fort Randall, Big Bend, Oahe, and Garrison—are in operation confronted the Fish and Wildlife Service with the task of mapping a broad habitat-replacement program. During the year the Service entered the initial stages of this enterprise on which detailed studies are going forward.

MARINE FISHERY RESEARCH

The pilchard fishery of the Pacific coast, which for many years led all United States fisheries in total production, has had several years of extremely small catches. The Service is investigating the extent and success of pilchard spawning to learn causes for apparent fluctuations in abundance and the oceanographic conditions in North Pacific waters which may be related to these changes. The activities of the Fish and Wildlife Service vessel *Black Douglas* are closely integrated with those of vessels of the California Division of Fish and Game and the Scripps Institution of Oceanography, which are engaged in similar studies off California. The *Black Douglas*, occupying 40 stations distributed along 4 lines running offshore from the Oregon coast for about 500 miles, collects information on physical, biological, and chemical characteristics of the water for analysis and correlation with other data on marine fishes of commercial importance.

Much of the work of the 25 cruises of the vessel *Albatross III* on the great north Atlantic fishing banks was devoted to a census of total fish populations. Data on operation of gear, number and size of fish caught, and temperature were obtained at 170 trawl stations. Summaries were made of catches by subarea, depth, temperature, and direction of tow. Haddock data were analyzed further by age. These data will help to predict abundance of haddock and to determine population size of all demersal fish on the banks. Small haddock were tagged in considerable numbers on Georges and Browns Banks for survival studies. The ship was used for 1 month during the year to investigate oceanographic conditions and the kinds, abundance, and distribution of fish and invertebrates in North Carolina coastal waters in cooperation with the University of North Carolina's Institute of Fisheries Research.

During the period of organization, laboratory construction, and ship conversion, the Section of Biology and Oceanography of the Pacific Oceanic Fishery Investigations, based in Hawaii, has completed collection of Japanese scientific papers dealing with research into tuna fishing and habits of tuna. A reconnaissance team in Japan, working under authority from SCAP, collected much of this material; the remainder came from United States Navy projects and the Fish and Wildlife Service's library. This collection, believed to be the most complete outside Japan, will be valuable reference material as the research program develops.

Fishery research in the middle and south Atlantic areas has been developed in close association with the States: a survey of the blue crab populations of the Rappahannock River to determine time, equipment, and personnel required for an extensive study of all Chesapeake Bay crabs; tagging of shad off the coast of Maine to study migration of the important fish along the coast; a seasonal study of striped bass spawning in Delaware waters; and extensive tagging and study of migrations of striped bass in the Santee and Cooper Rivers in South Carolina, where dams have changed natural conditions in important ways. Of particular interest has been the recovery of shad tagged in Maine from the waters of Chesapeake Bay, Georgia, and Florida. Tagging will be repeated this year.

Organized research by the Service to determine causes for the plague which in 1947 killed millions of valuable food fish in Florida west coast waters began during the year. The 60-foot vessel *Pompano* is used to obtain data on oceanography, planktology, and chemical constituents of the coastal waters from the mouths of fresh-water rivers to the 100-fathom line. The responsible organism is known, but the causes for its sudden increase in abundance—as many as 60,000,000 in a quart of water at the height of the scourge—and possibilities for predicting and controlling future outbreaks remain to be studied. The University of Miami's Marine Laboratory and the Florida Department of Conservation are actively cooperating in the work.

Although the clam fisheries of the country antedate the arrival of the white man and always have played an important role in the coastal economies of Indians and whites, remarkably little research has been done to learn the facts about the resource. During the year, it became possible to begin a study aimed at preventing depletion and developing ways of increasing the yield. Work has started in Massachusetts, Connecticut, Maine, Rhode Island, and New Jersey and will be extended to North Carolina during the coming year.

Other shell-fishery research was continued along the Atlantic and Gulf coasts, with some changes in emphasis. Research on the effects of operation of the Bonnet Carre Spillway on oyster grounds in Louisiana and Mississippi, to be completed this year, will determine whether claims of the oystermen against the Corps of Engineers will be accepted. Other research in the Gulf is directed toward control of the most serious oyster pest, a drilling snail, and, in cooperation with the State of Florida, rehabilitation of certain depleted oyster grounds. In the Chesapeake Bay States, development of seed-oyster beds and the general improvement of oyster production and management received principal attention.

Specially requested surveys of the possibilities for oyster culture in Puerto Rico and the Virgin Islands were completed and reports recommending initial limited experimental plantings under carefully controlled conditions were transmitted to the respective governments.

Research to improve the efficiency of fish hatcheries has been given special attention. Roccal, sulfa drugs, malachite green, and pyridylmercuric acetate have been tested and found to be effective in controlling disease. Pathologists have isolated organisms causing two fish diseases and are now experimenting with methods of control. Basic data on the nutritional requirements of hatchery fish are being applied to the development of special diets which utilize substitutes, such as meals, for meat products. Anemia has developed in many of the fish fed substitute foods, and experiments are in progress to discover the cause. Several liver extracts, including vitamin B_{12}, are being tested. Cod liver oil added to the diet has resulted in increased growth of brook trout but has had no effect on brown and rainbow trout.

Mass spraying of forests and marshes for insect control and of lakes rivers, and irrigation canals for aquatic weed control is now a common practice. To avoid undue losses of fish in treated areas, field and laboratory tests which have been made on insecticides and herbicides have resulted in recommendations as to the proper dosages.

Results of pollution studies on the Shenandoah River, where al aquatic animals were killed several years ago by zinc contained in the effluent of the Viscose Co., have led to the installation of a waste treatment plant by that company. Physical and chemical conditions now appear satisfactory for supporting aquatic life in the Shenandoah and some aquatic insects and fish have reached pre-pollution abundance.

The parasitic sea lamprey is threatening the $12,000,000 fishing industry of the Great Lakes. The seriousness of the menace is revealed by the 1948 commercial catch of lake trout which dropped to less than 5,000 pounds in Lake Huron and was only one-sixth of the normal 6 million pounds in Lake Michigan. With the decline of the lake trout the lamprey now preys upon other valuable species. A comprehensive research program is planned to develop methods of controlling the lamprey.

The Fish and Wildlife Service has the responsibility for regulating the fisheries of Alaska, and continuous observation is necessary in order that the various species of salmon and other foodfish may be conserved at the same time that maximum yields are secured. Study of the red salmon runs of Bristol Bay and Karluk Lake, Kodiak Island, was continued. Investigation of the pink salmon populations of southeastern Alaska, which have declined alarmingly during the past few years, was expanded during the year. Estimation of the size of downstream migrations of young pink salmon, essential to studies of their survival in fresh water, was accomplished by a new method in which a number of small traps are placed in the stream.

UTILIZATION OF FISHERY RESOURCES

The 1948 catch of fishery products by the fishing industry of the United States returned an income estimated at 325 million dollars to fishermen and retailed for nearly a billion dollars. Although the 4.6 billion pound catch brought into United States ports exceeded the prewar average, the expanded fleet had to go farther to reach the good fishing grounds, with added expenses for ice, fuel, and overhead. Higher operating costs and foreign competition made marketing of the domestic catch a little more difficult than it had been in the past. Declining European markets for United States products brought on by the dollar shortage and more intensive competition in the domestic market from foreign countries, which last year sent about 473 million pounds of fishery products to the United States, added to the normal supply available for consumption.

In general, the current year witnessed a lowering of the price levels and the lessening of inflationary tendencies in the fishery industries. Although new highs in prices and in gross incomes were being posted in 1948, during the first half of 1949 prices and incomes receded slightly.

Although the fishing fleet of the Nation has increased steadily since the war and early postwar years, the fleet operating out of Boston is smaller than it has been in recent years. Twelve otter trawlers which previously operated out of that port were purchased by the Army in the spring of 1949 for use in Germany, thus reducing the size of the fleet.

Problems related to imports and exports of fishery products, and to transportation of fish to domestic markets, continue to disturb the industry and have received serious study by Service economists. Basic data resulting from these studies were provided in cases heard by the Interstate Commerce Commission which involved railroad freight rates for fishery products and Railway Express Agency charges. In the field of international trade in fishery products, the Service assisted the Committee for Reciprocity Information in making its determinations with respect to tariff negotiations which were begun in April 1949, at Annecy, France. These negotiations involved several nations and supplemented the Geneva Agreements on Tariffs and Trade negotiated in 1947. Data were furnished the industry on fishery associations, unions, and cooperatives.

As a direct result of the king-crab investigation conducted by the Fish and Wildlife Service off the coast of Alaska in 1940 and 1941, the *Pacific Explorer*, an American factory ship operated by the Pacific Exploration Co., was designed to prepare products from king crabs and bottom fish in Bering Sea. During the summer of 1948 this ship, with its fleet of fishing vessels, sailed for Bering Sea with two Service representatives aboard as observers.

On July 1, 1948, funds were authorized by Congress for the acquisition of an exploratory fishing vessel and for its operation in Alaskan coastal waters. The *Washington*, a 100-foot motor vessel, was transferred to the Service from the Maritime Commission to carry on this exploratory work and to develop more efficient methods of gear operation. Early in 1949 the Economic Cooperation Administration purchased the *Washington* from the Service for $150,000, for use in the Korean fishery rehabilitation program. The Service will apply the money received from ECA to the cost of construction of a vessel more suitable for its exploratory fishing program in Northwest Pacific waters. The *Deep Sea*, a 139-foot Atlantic-coast-type trawler, was chartered to survey the fishery resources in the northern Bering Sea area, pending construction of the new vessel. A great amount of valuable information has already been obtained concerning migrations and dispersal of fish, trawling conditions, and ocean temperatures.

In order to utilize large reserves of food fish in northern Pacific and Alaskan waters and to improve the quality of North Atlantic fish, the Service conducted studies in freezing fish at sea. Limited tests in the field indicate that round fish can be frozen at sea, transported to shore stations, defrosted, filleted, and refrozen for storage and later marketing. Freezing fish at sea as soon as they are caught results in the retention of freshness and flavor which are often lost when ice or a refrigerant are used on vessels during long trips. Adoption of this method by fishermen, particularly in the northeastern United States area, will place them in a more favorable position in competing with quality fishery products from other nations located near the fishing grounds.

Technological investigations were continued in fiscal year 1949. The Fishery Products Laboratory at Ketchikan, Alaska, undertook a thorough study of the butter-clam industry in that area to produce a higher quality pack, and one commercial packer is already applying the methods developed in the laboratory in processing clams for the market.

To develop effective methods for improving the quality of fishery products, isolation and identification of micro-organisms from fish and the holds of fishing vessels were made to determine their role in fish spoilage. An indirect result of these studies was the discovery that certain cultures of bacteria produced "struvite" (magnesium ammonium phosphate) crystals, which, although harmless to the consumer have hindered the marketing of certain new canned fishery products.

As preliminary studies indicated that salmon cannery wastes can serve to replace some of the more expensive meat products usually included in the diet of salmon in fish hatcheries, additional studies were carried out to determine the parts of the salmon wastes most effectively metabolized by young fish and methods of processing the waste without loss of nutritional elements. Tests conducted in Federal hatcheries indicate that salmon viscera meal added to the diet at the 10-percent level produces better growth than offal meal and a drying temperature of 100° F. produces a meal of greater growth potential than does that of 145° F. or higher.

Some 20 fish cookery demonstrations and displays were given at universities and public-utility training schools for homemaker groups, cafeteria operators, home economists, and other groups engaged in food preparation. Three test-kitchen reports containing recommended methods for preparing fish were made available and large quantities distributed by trade interests. Tested recipes for preparing fishery products were provided for distribution in the National School Lunch Program in cooperation with the Department of Agriculture. To further insure efficient operations in the school-lunch field, Service home economists conducted 50 demonstrations of fish cookery for cooks, managers, and supervisors.

Monthly availability reports on the current fishery supply situation were provided national restaurant, food chain, hospital, and fishery associations and a quarterly market outlook report was instituted for the guidance of Government and trade in planning and developing fishery programs.

Three educational motion pictures were produced: Basic Net Mending, illustrating an approved, time-saving method of mending fishing nets; It's the Maine Sardine (produced with the financial cooperation of the Maine Sea and Shore Fisheries Commission and the Maine Sardine Packers Association), showing the catching and processing of Maine sardines; and Pacific Halibut Fishing, depicting a typical halibut vessel at sea and returning to market. The Department of State selected the first two of these films for entrance in international competition with similar films from other countries.

The fishing industry is dependent upon production and market statistics to operate efficiently and to insure preservation of the fishery resource which extends beyond State and National boundaries. To meet this need the Service collects, tabulates, and analyzes for distribution biological and economic data that aid conservation agencies in managing their fishery resources, assist the industry in conducting its business activities, and enable Government agencies to take the necessary action to protect the domestic fishing industry.

General statistical surveys of operating units and catch were continued in 1949 in the Pacific coast, New England, Middle Atlantic, and Chesapeake Bay States and resumed after a lapse of a year in the important Gulf States. The Service publication of monthly and annual bulletins on the landings of fishery products in Maine and at the principal Massachusetts ports, on the freezing of fishery products, holdings of frozen fish, shellfish, cured fishery products, and fish meal and oil continued. Information on the volume and value of canned fishery products, byproducts, and packaged fish for 1948 was released.

Seven Fishery Market News field offices were operated during fiscal year 1949. The Hampton, Va., office was reopened in August 1948, as additional funds were appropriated for this purpose. The reporting area of the New Orleans office was extended to include the lower part of the Texas coast to which the shrimp fishery had recently expanded. This office also was able to obtain weekly data from practically all the canning plants which pack oysters, shrimp, and crabmeat in the South Atlantic and Gulf States, and to disseminate this information in the daily Fishery Products Reports. In cooperation with the Department of Agriculture the Service now obtains weekly fish meal and oil prices for the Atlantic and Gulf coasts and fish meal prices of the Pacific coast for release to the industry.

Import data on fishery products, collected by the Bureau of Customs, were published in daily reports for distribution to the fishery industry and allied interests, making these data available about a month in advance of their regular publication by the Department of Commerce. Through the cooperation of American embassies and consular offices in foreign countries, a large amount of information on foreign fisheries, especially as it affects the fishing industry in this country, has been reviewed and released through the Service's monthly publication, the Commercial Fisheries Review.

Cooperative work with the Bureau of Labor Statistics in revising the wholesale price index on fishery products, has resulted in a more realistic index and one which reflects more accurately the trend in prices. Most of the price data used for this index are collected by the fishery market news service.

COOPERATIVE CONTROL OF PREDATORS AND RODENTS

Sportsmen, stock raisers, farmers, and foresters have reported greater benefits from the control of harmful animals during the past year than in any previous year. Throughout the United States and also in Alaska there have been fewer losses of game, livestock, and poultry from predatory animals and lessened damage to stored foods, crops, orchards, range lands, and forest plantations by destructive rodents. This is due not only to the use of modern control methods, as the airplane, compound 1080 (sodium fluoroacetate), and the "coyote-getter," but also to the splendid cooperation of States, counties, cities, and associations of farmers and stockmen. Cooperative agreements were in effect with 34 States this year. States contributed $1,125,463; counties, cities, livestock associations, and others contributed $2,130,262; and Federal appropriations provided $1,060,595; making a total of $4,316,320 expended in cooperative predator and rodent control during the year.

The recorded catch of predatory animals consisted of 75,448 coyotes, 1,036 wolves, 8,231 bobcats and lynxes, 652 stock-killing bears, and 131 mountain lions. In rodent control operations 14,583,652 acres of land were treated for the control of prairie dogs, ground squirrels, pocket gophers, jack rabbits, field and orchard mice, cotton and rice rats, kangaroo rats, porcupines, and woodchucks. In addition, 499,326 premises were treated in cooperative campaigns for the control of house rats and mice. Equipment and supplies used in predator and rodent control and 423,371 pounds of rodent bait materials were distributed to cooperators throughout the country by the supply depot at Pocatello, Idaho.

Protection of game from predator attacks was especially noteworthy in Alaska, where an appropriation of $100,000 enabled the Service to start the first organized predator control program in the history of the Territory. Nine experienced men were employed; 2 planes were secured for transportation in roadless areas, and automobile transportation was provided where needed. A small vessel, the *Black Bear*, was reconditioned for wolf-control operations along the shorelines of southeastern Alaska. Work was concentrated in areas where wolf and coyote depredations had most seriously depleted moose, caribou, mountain sheep, and reindeer. Standard control methods were adapted to Alaskan conditions and results of the operations were carefully checked, especially with regard to their effect on all forms of Alaskan wildlife. Reports show increased survival of moose calves in the region around Anchorage last winter, decreased losses of reindeer on the ranges around Norton and Kotzebue Sounds and Seward Peninsula, and no apparent disturbance of fur animal populations in the Territory.

There were even more outstanding benefits to game from predator control in southwestern United States. For several years the Arizona Game and Fish Commission has cooperated with the Service on predator control and has conducted parallel studies of results. It is now clearly apparent from these studies that antelope fawn survival is directly proportional to the extent and effectiveness of coyote control on antelope ranges. Survivals of 94 percent were estimated this year on well-controlled areas and as low as 21 percent on similar areas lacking such control. Comparable results were found with turkey and deer. In central and northern States, game managers report unusually good crops of sagehen, ptarmigan, and grouse in areas where coyotes and bobcats have been reduced in numbers. The game commissions of Arizona, California, Idaho, Montana, Oregon, Texas, and Wyoming report decidedly less predation this year on deer, antelope, sagehen, grouse, turkey, pheasant, and quail.

Domestic animals and poultry have benefited more from predator control this year than in any previous year since the work was started by the Service in 1916. In many parts of the West sheep are being ranged without herders and without predator losses, where formerly annual losses up to 15 percent were common despite the constant attendance of herders. Calf losses were also reported to be entirely eliminated in many localities from North Dakota to Arizona, and from south Texas to the Pacific Northwest. Predation on turkey and other poultry was also checked, notably in central California, the Willamette Valley of Oregon, Utah, and the intensive poultry raising areas of New York, New Jersey, and New England. There still remain areas, as the San Luis Valley of Colorado, the mesquite thickets of south Texas, and some of the Badlands of the Dakotas, where environments are so favorable to predators as to make reduction very difficult and costly. Also, in many places coyote control is not a de sirable management practice, as wilderness or recreational lands and regions where livestock is absent and game populations are not depleted by predation. The constant drift of predators from such areas requires maintenance of a "border patrol" type of predator control in order to protect adjoining areas. For this reason stockmen in the so-called "coyote-free" region of Texas gladly contribute cooperative funds to maintain a line of hunters just outside the area although in some cases the herds that are being protected may be many miles away.

The continued vigilance of trappers along the United States-Mexican boundary has kept both wolves and mountain lions from penetrating far into this country, and has also been of value in preventing the spread of rabid animals into the United States from Mexico. Plans for the expansion into Mexico of control operations involving rabid wild animals were discussed by Service officials at the international conference held April 24, at Nogales, Ariz., under the auspices of the Pan American Sanitary Bureau.

The Service cooperated with health authorities, fox hunting clubs, county and State officials in Alabama, California, Georgia, Mississippi, and New York in the control of rabid foxes and coyotes. Service representatives attended a tri-State conference of officials from New Jersey, Pennsylvania, and New York at New York City, December 15, 1948, to assist those States in planning for suppression of the stubborn rabies epidemic in that general region. A Service hunter was also assigned to demonstrational fox and coyote control for a period of 3 months in the Adirondack Mountains in cooperation with the State of New York.

Shooting coyotes from airplanes gave spectacular and prompt relief to stock raisers and game managers wherever conditions permitted use of planes. A special appropriation by the North Dakota State Legislature financed cooperative plane hunting that accounted for a little over a half of the 1,578 coyotes in that State. The planes were in operation during most of the time that roads were blocked by snow, and their use prevented heavy losses from coyotes. Utah, Wyoming, and Oregon also used planes, but to a reduced extent. Snow-covered country, relatively level and free of brush or trees, is needed for such work, and these States have less terrain adapted to such hunting. In many parts of Alaska, however, the plane is a necessity for both hunting and transportation of the hunters.

Although the general trend of rodent populations remained at low levels this year, there were numerous places throughout the United States where local conditions caused infestations requiring control to prevent damage to crops, forage, orchards, and forest plantations.

Control of pocket gophers must be maintained annually on irrigation projects in many parts of the West to prevent damage to water-control structures and subsequent water losses. As the result of cooperative agreements between the Service and the Elephant Butte and Carlsbad irrigation districts in New Mexico, and the Salt River, San Carlos, and Roosevelt districts in Arizona, great savings were effected this year in priceless water supplies.

Also on a continuing basis is the control of prairie dogs on range lands, and although this species has been brought well under control in past years, there are still scattered areas in Arizona, Colorado, the Dakotas, Montana, New Mexico, Oklahoma, Texas, Utah, and Wyoming that require attention. Compound 1080 and cyanide gas are effective in this type of operation.

Orchard mice continue to be troublesome in Utah, Oregon, and Washington, and in the latter State the Service's cooperative program to control these pests was more extensive than ever before, with 132,470 pounds of poison bait being distributed. Mouse control in connection with the airplane reseeding of Douglas fir continued in cooperation with National, State and commercial foresters in the Pacific Northwest where unusually economical and effective methods are being developed. Mole control in Oregon was also continued and expanded somewhat. In sections of the South, cotton rat control resulted in great savings to truck farmers and sugarcane planters.

Jack rabbits are increasing after a long period of low numbers. Arizona was the first to report an upswing in their numbers, 3 years ago. The increase was noted in an area having numerous coyotes and in which no coyote control had been exercised for several years. The most pronounced increases in jack rabbits came this year from northeastern Nevada and western Oklahoma, although in both areas coyote populations are relatively high and in Oklahoma, increasing. Some control of jack rabbits is being done locally in western States in response to requests from cooperators.

Public interest in rat control was appreciably greater throughout the country this year, as a result of the National rat control program carried on last year with emergency food conservation funds. Many cities have continued the work started then, and the consensus of opinion is that rat populations in the United States as a whole are decreasing slightly. In the North Central States, however, there are signs of an upswinging population cycle. New York City has vigorously conducted a rat campaign started at the close of the previous year; and in several States, including Colorado, the Dakotas, Louisiana, Mississippi, and Texas, nearly all large towns are continuing effective rat control programs. Sustained interest in rat control has occurred in communities along the lower Columbia River, where the

Service carried on concentrated rat control with emergency funds following the floods of last year.

The South Atlantic States furnished an outstanding example of the economy of the rat-control program carried on by the Service in cooperation with citizens and local governments. Assistance in the form of rat-proofing, clean up, and rat-poisoning was given to nearly 110,000 cooperators in 141 counties in Florida, Georgia, Kentucky, North Carolina, and South Carolina at an average cost of only $1.22 for each premise or property treated.

ADMINISTRATION OF ALASKA FISHERIES

Revised regulations for the protection of the commercial fisheries of the Territory were issued by the Secretary of the Interior on January 24 for the 1948 season. Major changes in these regulations over the preceding year included a uniform opening date for pink salmon fishing in all districts of southeastern Alaska, about 2 weeks later than in 1947, with somewhat later closing dates.

Fishery patrol facilities during the 1948 season included 9 seagoing patrol vessels, 16 speedboats and numerous small craft, and 8 airplanes. Twelve permanent agents supervised the fishery management work, assisted by fishery biologists, game management agents, and seasonal personnel.

A total of 196 persons and concerns was apprehended and arraigned for violations of the Alaska fishery laws and regulations in 1948. Fines totaling $33,955 were assessed and jail sentences totaling 900 days were imposed, of which 480 were suspended. Proceeds from the sales of confiscated fish amounted to $9,656.43.

Products of the fishing industry in Alaska in 1948 totaled 306,162,827 pounds, valued at $116,948,814. Salmon products represented 69 percent in volume and 87 percent in value of the total fisheries output in 1948. Canned salmon comprised 91 percent of the volume of all salmon products, and totaled 4,014,572 cases or 192,699,456 pounds, valued at $96,522,290. This is a decrease from 1947 of 7 percent in quantity and an increase of 9 percent in value.

Thirty-two herring plants were operated in Alaska in 1948 as compared with 24 in 1947. Of these, 15 were in southeastern Alaska and 17 were in central Alaska. The products of the industry totaled 58,388,893 pounds valued at $5,694,889. This was a decrease of 9 percent in volume and 13 percent in value from the preceding year. Landings of halibut from the Alaska fleet totaled 26,329,997 pounds, valued at $4,788,524, as compared with 25,583,928 pounds, valued at $5,116,440 in 1947.

Shellfish operators in 1948 produced 1,811,379 pounds of shellfish products valued at $2,004,297, as compared with 1,158,680 pounds, valued at $1,074,667 in 1947.

A total of 70,142 fur-seal skins was taken on the Pribilof Islands in 1948, compared with 61,447 in 1947. The annual census of the herd indicated its size to be 3,837,131 animals. The byproducts plant operated in connection with the fur-seal industry produced 47,711 gallons of seal oil, and 341 tons of meal which were sold for the account of the Government for the total gross amount of $79,480. During the winter of 1947–48 a total of 1,093 blue and white fox pelts was taken on the Pribiliof Islands as compared with 1,040 during the preceding winter. This operation is incidental to sealing activities.

During the fiscal year ending June 30, 1949, two public auctions of fur-seal skins were held at St. Louis, Mo. A total of 22,989 skins was offered on September 27, 1948, and sold for a gross amount of $1,363,509.50. Of these skins 22,964 were dressed, dyed, and finished in three shades, "Matara," "Safari," and the traditional black. Thirteen skins were sold unhaired and dressed, and 12 were sold raw. On April 11, 1949, there were offered and sold 27,861 dressed, dyed, and finished skins, the gross sales price being $1,659,165.00. In addition, there was sold during the year at private sales for promotional purposes a total of 129 dressed, dyed, and finished fur-seal skins for a gross sum of $8,797.80. Total gross sales of seal skins during the year amounted to $3,031,472.30. During the year also, 974 fox skins from the Pribilof Islands were sold for a total of $4,191.

ADMINISTRATION OF FEDERAL STATUTES FOR PROTECTION OF WILDLIFE

The eight principal statutes administered by the Service for the protection of wildlife are the Migratory Bird Treaty Act, Lacey Act, Migratory Bird Conservation Act, Migratory Bird Hunting Stamp Act, law protecting wildlife and property on Federal refuges, Black Bass law, Bald Eagle Act, and the Alaska Game law. These laws and the regulations thereunder are enforced in the United States by 6 regional supervisors of law enforcement and 73 United States game management agents.

In addition to the eight wildlife statutes, the Service enforces the laws and regulations for the protection of the commercial fisheries in Alaska, the Northern Pacific Halibut Fishery Act, and the Sockeye Salmon Fisheries Act.

There is still need for enlarging the number of personnel engaged in law enforcement operations. The present force is insufficient to cope adequately with enforcement and depredation problems. The staff of law enforcement agents is, however, rendering excellent service and is furthering cooperative relationships with State game departments in connection with State game and fish law offenses. Details of activities are given in tables 4 and 5.

A Fairchild four-place aircraft donated to the Fish and Wildlife Service by William C. Sweet of Attleboro, Mass., for use by game-law enforcement personnel has been extremely helpful in the patrol of wildfowl concentration areas.

TABLE 4.—*Summary of penalties imposed during the year for violations of wildlife conservation laws, 1949–50*

Act	Convictions	Fines and costs	Jail sentences
	Number	*Dollars*	*Days*
Migratory Bird Treaty Act	619	31, 374. 22	2, 108
Migratory Bird Conservation Act	28	1, 000. 00	180
Migratory Bird Hunting Stamp Act	29	616. 00	
Wildlife Refuge Trespass Act	2	400. 00	
Lacey Act	3	665. 00	
State prosecution from Lacey Act investigations	22	1, 287. 00	
State laws, cooperative prosecutions	2, 469	113, 468. 03	305
Total	3, 172	148, 810. 25	2, 593

TABLE 5.—*Cases of violations of the Migratory Bird Treaty Act disposed of during the year, and cases still pending on June 30, 1949*

Disposition	Number	Pending	Number
Conviction	619	From preceding year	210
Dismissal	19	New cases	793
Nol pros	28		
Closed without prosecution	24	Total	1, 003
Found not guilty, jury trial	34	Disposed of during year	726
Closed, by death	1	Pending at end of year	277
No true bill	1		
Total	726		

Operations in California in conjunction with State officers to apprehend persons suspected of killing or possessing waterfowl for commercial purposes proved fruitful. Three individuals were taken into custody with over 1,000 dead birds in possession. On arraignment in Federal court, one defendant was fined $2,500 and sentenced to 30 months in jail, another $1,500 with 1 year in jail, the third was fined $1,800 and placed on probation for 5 years. Another hunter in California, who pleaded guilty to possessing ducks in closed season, was fined $500. Five other cases, where the offenses related to purchasing, offering to purchase, or illegal possession of ducks, were closed by fines of from $300 to $500 each. In addition, 86 persons charged with possessing waterfowl in excess of legal limits and prosecuted in State courts in California, were either fined or forfeited bonds aggregating $10,995. Another heavy fine was imposed in Federal court at Tallahassee, Fla., against a defendant charged with hunting and killing ducks during the closed season. He was fined $1,000 and also placed on 5 years' probation.

Five cases for violation of the Northern Pacific Halibut Act were disposed of before a United States Commissioner in Alaska, fines ranging from $50 to $150 each and aggregating $550. One case was disposed of in a Washington State court by a fine of $1,000. Joint patrol incident to enforcement of the Sockeye Salmon Fisheries Act was maintained by agents in cooperation with personnel of the Washington State Fisheries Department, resulting in several prosecutions in which fines were imposed.

Of the 107 prosecutions for violations of the Alaska Game Law, 103 cases were terminated by convictions, and 4 resulted in acquittal of the defendants. Fines totaled $12,725, of which $390 was suspended. Jail sentences of 1,635 days were imposed, of which 1,470 were suspended. Many carcasses of moose, caribou, deer, and game birds were delivered to charitable institutions for use as food. Other seizures included 43 rifles, 2 pistols, 1 outboard motor, and the skins of 1 sea otter, 21 marten, 15 mink, 90 beaver, and 8 bear.

Sixteen persons were convicted for violating the Northern Pacific Fishery Act and 1 defendant was acquitted. Fines totaled $4,750 plus seizure of halibut valued at $1,981.21.

By amendment to section 241 of the Lacey Act, the issuance of permits for the entry of foreign live wild animals and birds was transferred from the Fish and Wildlife Service to the Treasury Department's Bureau of Customs. However, migratory birds for scientific or propagating purposes are subject to regulations issued under the Migratory Bird Treaty Act.

The following migratory bird permits were issued during the year: To collect for scientific purposes, 323 (287 last year); for propagating purposes, 346 (293 last year); to capture for propagation, 24 (21 last year); to band birds, 124 (54 last year); to take birds or game in Alaska, 71. A total of 42,551 waterfowl was reared under propagating permits, a decrease of 6,659 over last year. The number sold for food was 9,218; for propagating purposes 8,439; and 9,044 were liberated.

At the end of the fiscal year permits outstanding were as follows: Propagating, 3,449; scientific collecting, 2,164; scientific possession, 592; special possession, 3,545; bird banding, 2,726.

COOPERATION WITH AMERICAN REPUBLICS

The Interdepartmental Committee on Scientific and Cultural Cooperation was created by the President in May 1938 to facilitate the solution of problems of common interest to the peoples of the American Republics. The Congress, through enactments in 1939, authorized the conduct of cooperative programs and the exchange of technical specialists. The United States Information and Educational Exchange Act of 1948 extended the authorization to almost all nations of the world, but no funds have been appropriated to implement the extension. The program of scientific and cultural cooperation has been highly successful in bringing about an exchange of information and techniques, and increasing understanding among peoples of the Western Hemisphere.

President Truman, in his inaugural address of January 20, 1949, stated that the United States should make available American scientific and technical knowledge to underdeveloped areas of the world and should encourage capital investment in those areas to help achieve peace, plenty, and freedom. Implementation of the President's Point Four program is still in the formative stage, but it is expected that a greatly expanded program of cooperation will emerge in the near future.

The fishery mission to Mexico, established in 1942, was extended for a 2-year period in 1948. The most significant development of the past year was the signing of a fishery treaty by Mexico and the United States. The treaty, signed at Mexico City on January 25, 1949, provides for the scientific investigation of tuna, as related in greater detail later in this report. The mission was instrumental in assembling the scientific and technical information essential to successful negotiation of the treaty.

Early in August 1947, negotiations were completed between the Governments of Venezuela and the United States, for assignment of a fishery biologist to conduct marine investigations, with special attention to the biology of sardines in the Gulf of Cariaco. Field work of the mission began in February 1948, and continued for a year.

A marine fishery laboratory was established at Caiguire, on the Gulf of Cariaco, and a 65-foot vessel assigned to the project. Statistical and biological studies of the sardines of the Gulf of Cariaco showed that the population was a migratory one, and that the fluctuations in abundance, therefore, were not subject to full control by restrictive measures applied in the Gulf of Cariaco. A series of experiments was carried out in Lake Marcaibo to estimate probable damage to fisheries as a result of proposed underwater seismographic exploration explosions. Management and conservation measures respecting pearl oysters and "Pepitonas" (the cockle, *Arca occidentalis*) were prepared for the Ministry of Agriculture.

In May 1949, at the request of the Peruvian Government, the Service assigned an aquatic biologist for a period of 2 months to assist that Government in planning a wholesale fish terminal and a technological and biological laboratory, in collecting biological and production statistics, and compiling of laws and regulations relating to fish and game.

The ornithological survey of Cuba, inaugurated in 1948 at the invitation of that Republic, was resumed in January 1949. Three ornithologists of the Service, cooperating with a Cuban naturalist, devoted 2 months to a study of the important waterfowl concentration areas, methods of hunting, and other factors that affect the North American ducks and other water birds which go to that country for the winter season. One member of the party also spent 3 weeks making similar surveys in Haiti and the Dominican Republic, also at the invitation of those countries.

Although a large segment of the waterfowl population of the Atlantic Flyway spends the winter season in the West Indies, the investigators found that the total hunting kill in that area was small. Natural food supplies are generally ample, but variable according to the salinity of the waters. Enforcement of the game laws in all three of the countries visited is vested in the military establishments. Data collected during the two years have made an important contribution to our knowledge of the kinds and abundance of the birds and of the conditions under which they live in Cuba, Haiti, and the Dominican Republic.

The Fish and Wildlife Service continued its program of training qualified students of other American Republics in several phases of biological science and management in relation to the conservation of fish and wildlife resources. Twenty-four students have received training since the program started in 1942.

The Department of State continued its program of awarding travel grants to scientific and cultural specialists. Awards may be made to nationals of American Republics for travel in the United States, or to citizens of the United States for travel in the American Republics. Most of the grants are made to foreigners. During fiscal year 1949 three awards were made, in cooperation with the Fish and Wildlife Service, to persons interested in fisheries or in general conservation of renewable natural resources.

REHABILITATION OF PHILIPPINE FISHERIES

The objectives of the Philippine Fishery Program, together with information on the means employed to attain them, have been presented in detail in earlier reports. The present report is limited to a record of progress made in realization of the objectives.

The Fish and Wildlife Service is authorized to train in the United States not more than 125 Filipinos in phases of fishery industry and science. At the end of fiscal year 1949, 101 persons had entered the 1-year training period, and it is expected that the entire program will have been completed by September 1950. This growing body of trained technicians gives a firm basis for optimism with regard to the orderly development of the fishing industry in the Philippines. Returning trainees have been absorbed quickly by industry or by the Philippine Bureau of Fisheries.

As it has been demonstrated experimentally and by exploratory fishing projects that the fisheries of inshore waters near Manila cannot produce supplies of edible fish adequate for the needs of the people, due largely to overfishing, particularly with explosives, there is need for more intensive use of the more distant inshore areas and of the offshore waters. Progress has been made in increasing the use of otter trawlers, and experiments with gear are continuing in the hope of discovering improved methods and more ample sources of bait fishes.

Studies have been made of marketing conditions in several provinces, with special reference to the kinds and abundance of fishes, transportation and preservation facilities, prices, and other factors which bear upon domestic consumption of the fresh products.

Oceanographic investigations have yielded a large volume of data on physical, chemical, and biological conditions which determine the basic productivity of the sea. Hydrographic conditions in the vicinity of the Islands are extremely complex, and the short-term studies under the program are not sufficient to solve all of the problems encountered. These studies will serve as a point of departure for future investigations to be conducted by the Philippine Bureau of Fisheries as part of its continuing research program.

Investigations of the rearing of bangos in ponds were hampered by destructive typhoons in 1947, but the facilities have been replaced, and increased in some areas. Opportunity exists for great expansion of production of fishes in ponds and the outlook is encouraging for this important source of low-cost protein food.

WHALING

In the summer of 1948, a biologist was assigned to the single United States whaling station, located in California, to obtain biological and statistical data on the whales captured and processed, and to make observations on the abundance and distribution of whale populations. Information of this kind is essential as a basis for international regulations designed to conserve and rehabilitate the depleted whale populations.

The biologist devoted 2 weeks to observations of whaling activities in the area of Vancouver Island, British Columbia, Canada. Also, in response to the request of local fishing interests in Maine, the biologist made a preliminary survey of whale populations in that area. He found significant numbers of whales in the general area of northeastern Maine and the Bay of Fundy, and it is probable that the population is sufficiently large to support a shore-whaling station serviced by two killer boats.

Owing to the fact that the whaling station in California did not operate in the summer of 1949, the biologist devoted the usual field period to bibliographic and statistical research in Washington.

The International Agreement for the Regulation of Whaling signed at Washington, December 2, 1946, entered into force on November 10, 1948. The first meeting of the International Whaling Commission, established under the authority of that convention, was held at London from May 30 to June 7, 1949. The following governments who have ratified or adhered to the 1946 Convention were represented by commissioners: Australia, Canada, France, Iceland, the Netherlands, Norway, South Africa, Sweden, the United Kingdom, the United States of America, and U. S. S. R. The following governments and organizations were represented by observers: Argentina, Brazil, Chile, Denmark, New Zealand, FAO, and SCAP.

Much of the time of the Commission was spent in organizational matters, including the drafting of rules of procedure. Amendments were made to the international whaling regulations contained in the schedule annexed to the 1946 Convention. The pelagic whaling season for the Antarctic was altered from December 15 to April 1, and effective for the 1949–50 season will become December 22 to April 7. The total ban on the taking of humpback whales south of 40° south latitude was relaxed to the extent that in each of the whaling seasons 1949–50 and 1950–51 a maximum of 1,250 humpback whales may be taken in that area. Paragraph 10 of the schedule dealing with the conditions for the operation of land stations and whale catchers attached thereto was revised in the interest of clarity. Likewise, paragraph 17 of the schedule, which specified conditions under which factory ships may operate solely within certain territorial waters, was revised in the interest of clarity. The Commission will hold its next meeting at Oslo, Norway, beginning July 15, 1950.

INTERNATIONAL FISHERY PROBLEMS

The success, during the past 25 years, of international agreements providing for the investigation and management of fishery resources of the high seas of interest to more than one nation has led to the application of the international agreement approach to other fishery problems during the current year. The Fish and Wildlife Service has cooperated actively with the Department of State in the preparatory work and in the actual negotiations.

The International Convention for the Northwest Atlantic Fisheries was concluded on February 8, 1949, by the United States, Canada, Denmark, France, Iceland, Italy, Newfoundland, Norway, Portugal, Spain, and the United Kingdom. The principal feature of the agreement is the provision for the establishment of an international commission composed of not more than three commissioners representing each signatory government. The commission shall have the power of conducting investigations, which shall be carried out primarily by fishery research agencies of the contracting governments working on a cooperative basis, and of recommending regulations for the conservation of the fisheries which are to be implemented by each government in respect to its own nationals and vessels. Through the medium of this international body it will be possible to keep under continuous biological and statistical review the fisheries of the Northwest Atlantic. When necessary, regulations can be adopted in the interest of conservation that will apply to all vessels operating in the area. Because the Northwest Atlantic fisheries are international, regulation, although badly needed for certain species, has been considered impractical because the fishermen of no one nation would agree to the imposition of regulations, as fishermen operating on the same grounds were not subject to the same regulations.

The Convention between the United States and Mexico for the establishment of an International Commission for the Scientific Investigation of Tuna was signed at Mexico City January 25, 1949. While the agreement provides only for investigations, the negotiators felt that since the tuna fisheries have not previously been studied exhaustively considerable knowledge should be accumulated on an international basis before any international device for regulation is established.

A convention between the United States and Costa Rica for the establishment of an Inter-American Tropical Tuna Commission was signed at Washington on May 31, 1949. The agreement is open to adherence by other interested governments. It is similar in purpose and objectives to the agreement between the United States and Mexico.

On November 9, 1948, the agreement concluded at Baguio, Philippines, February 26, 1948, for the establishment of an Indo-Pacific Fisheries Council became effective by reason of its approval by five of the contracting governments. The first meeting was held at Singapore, Straits Settlements, March 24–31, 1949, and was attended by delegates from Australia, Ceylon, China, France, India, the Netherlands, Philippines, the United Kingdom, and the United States of America, and by observers from Korea, SCAP, South Pacific Commission, and UNESCO. The secretariat, pursuant to the agreement, was provided by FAO.

At its final session the council referred to the standing committees problems to be investigated and reported on at the 1950 meeting, including: (1) collaboration of member governments in a study of the tuna, herring-like, and mackerel-like fisheries; (2) collaboration in fish culture of fresh-water and salt-water species; (3) cooperation in the compilation of descriptive catalogues of indigenous fishing gear and fish processing methods. The next meeting of the council is tentatively scheduled to be held in Australia during March 1950.

The National Park Service

Newton B. Drury, *Director*

"NATURAL beauty is the ultimate spiritual appeal of the universe or of the God of Nature, to their nursling man * * *. But science and machinery have now armed him with weapons that will be his own making or undoing, as he chooses to use them; at present he is destroying natural beauty apace in the ordinary course of business and economy. Therefore, unless he now will be at pains to make rules for the preservation of natural beauty, unless he consciously protects it at the partial expense of some of his greedy activities, he will cut off his own spiritual supplies, and leave his descendants a helpless prey forever to the base materialism of mean and vulgar sights."

These lines, written by G. M. Trevelyan, are found in a document entitled "Britain's Heritage: A Record of the National Trust," published in London in 1947. Though written specifically of Great Britain, their basic truth is of universal application. Their warning surely deserves the consideration of thoughtful Americans, particularly now, when physical changes in the outward look of our country are being made or are planned on a scale—and at a cost—hardly dreamed of a decade ago. Certainly they warn us of our responsibility as civilized human beings, capable of appraising and weighing opposed values, to examine all proposals to effect extensive modification of the American landscape, to harness our waters, to cut down our forests, to rob our wildlife of suitable habitat and to invade our wildernesses; to examine the issues involved, so that we may make certain beyond the possibility of mistake, before it is too late, that the real gains (as distinguished from limited and temporary economic advantage) are more than sufficient to balance the losses.

Those words from across the Atlantic are such as to inspire us to cherish and protect the national parks. They are of a sort to strengthen the growing conviction in America that there are certain values in our native landscape that ought to be sustained against destruction or impairment; that, though their worth cannot be expressed in money terms, they are essential to our "life, liberty, and the pursuit of happiness": that this Nation of ours is not so rich it can afford to lose them; that it is still rich enough to afford to preserve them.

Glacier National Park saved from disfigurement.—During a year marked by many advances in the several fields of National Park Service activity, perhaps the most notable was the decision of the Department of the Army to eliminate the Glacier View Dam project from its program of development in the Columbia River Basin. This project, which would have involved the destruction of nearly 20,000 acres of exceptionally important wilderness along the North Fork of the Flathead River, in Glacier National Park, had been opposed unanimously by conservation groups throughout the Nation.

Diversion of Colorado River from Grand Canyon averted.—No less gratifying was the Department's decision to eliminate the Kaibab Tunnel project from the comprehensive scheme being developed for the Colorado River. This project was unique in that, though no part of it would have been constructed in Grand Canyon National Park, it would have profoundly affected the most important single element in the Grand Canyon picture—the river which has been the principal agent in carving the canyon through the slowly uplifting rock. The project contemplated the construction of a dam in Marble Canyon, upstream from the park, and diversion of the flow of the river through a long tunnel under the Kaibab Plateau to a powerhouse on Kanab Creek. This would have meant that the only appreciable flow through the Grand Canyon would have been from the Little Colorado River which usually, during the summer months, has no above-ground flow at all.

Ultimate upstream developments on the Colorado are certain to modify the flow of the river through the Canyon in some degree. The comprehensive development of the river for power and irrigation is looked upon as too important to the country as a whole to justify any effort to block it. However, with the tunnel project eliminated, the whole volume of the river will flow through the Grand Canyon, as it has done for millions of years.

Rocky Mountain spared transmission line.—The disfigurement of a tower transmission line across Rocky Mountain National Park was prevented when the Commissioner of Reclamation decided to transmit power for the operation of the Granby pumping plant on the Colorado-Big Thompson project by cable which will be strung through the Alva B. Adams irrigation tunnel, under the Continental Divide.

Mammoth Cave threatened by dam.—A continuing threat is that of the Mining City Dam project of the Corps of Engineers, a part of the Corps' comprehensive plan for flood control and power development of the Ohio River and its tributaries.

House bill 5472, which would authorize the expenditure of $75,000,000 on previously approved projects in this program, was under consideration before the House Public Works Committee at the end of the fiscal year. The Mining City project was authorized in 1938, but, because of the fact that it would cause additional flooding of the Echo River Channel in Mammoth Cave National Park and would aggravate the problem of silt deposition there, the Service feels obliged to oppose its construction.

Impartial appraisal of projects needed.—Of significance in connection with threats such as these is the recommendation of the Hoover Committee that Federal water-impoundment projects be subject to an impartial board of review, so that each project may be fully justified economically and socially and that there may be effective coordination from the inception of such projects. The National Park Service, administering areas which it is obliged to retain unimpaired for the enjoyment of future generations, is constantly faced by threats to the integrity of many areas, such as those mentioned above. It is justified, therefore, in seeking assurance that, if any construction project is to invade an area in the National Park System, it shall be undertaken only "on the basis of need so pressing that the economic stability of the country, or its existence, would be endangered unless such use were permitted," to quote Secretary Krug's forthright statement on protection of the parks and monuments. Such an issue needs to be decided by an impartial tribunal.

Landmarks of progress.—Establishment of the San Juan National Historic Site to embrace the ancient fortifications of the Puerto Rican capital was a noteworthy event of the past year. Other events deserving special mention include the announcement of the Department's revised concessions policy; the completion of modern museums at Manassas National Battlefield Park and Guilford Courthouse National Military Park; completion of the Jackson wing of the Scotts Bluff National Monument Museum, and continuing progress in museum planning and development, with numerous donations of funds and exhibits; the gift of land for the DeSoto National Memorial in Florida; two large land purchases in Everglades National Park, and acquisition of important properties in several areas of the National Park System; progress in the rehabilitation of concession facilities and some—though still far from adequate—additions; the renewal, for 20 years, of the concessions contract with the Utah Parks Co.; a successful National Park Service conference at Grand Canyon National Park; effective participation in winter storm relief activities by Service personnel and equipment; and continued devoted performance of duty by Service personnel in field and central offices.

The National Park Service is still severely handicapped by serious inadequacies of personnel throughout the organization and of funds for greatly needed developments of all sorts. Three disastrous forest fires highlighted the need of modernized communications throughout the system. Though the Interior Appropriation Act had not been passed at the end of the year, there were many reasons to feel that there would be better provision for the Service during the 1950 fiscal year.

The Department's Centennial.—Although the National Park Service is one of the younger bureaus of the Department of the Interior, two of the areas which it administers—Yellowstone and Hot Springs National Parks—represent probably the earliest examples of the allocation of land to conservation-and-use under the Department's control. Attainment of the Department's one hundredth birthday on March 3 gave the Service an opportunity to participate with all other bureaus and offices of the Department in a series of ceremonies which must surely have made many Americans more keenly aware of the existence of the Department and the importance and scope of its work, particularly in the conservation field. All of the many field offices of the Service have been encouraged and urged to seize every occasion to call attention to the anniversary and to develop better public understanding of the conservation principles of which Interior is the exemplar.

Jackson Hole and Olympic.—Though the controversy over Jackson Hole National Monument cannot be said to be closed, time appears to be working definitely in the monument's favor. The points of difference seem now virtually to have been narrowed down to the problem of control of the Jackson Hole elk herd.

A mid-April meeting of National Park Service and Wyoming representatives resulted in no unanimous conclusions and no commitments, but did serve to foster in each of the participants a better understanding of the viewpoints and positions of the others. The Service maintains that the necessary herd reduction can be effected by hunting outside the monument, primarily through greater flexibility in determining hunting seasons, because the greater portion of the herd is not protected by the monument for any significant length of time. The Wyoming Fish and Game Commission believes otherwise. All at the conference, however, appeared agreed that further cooperative study of the elk problem was needed.

The threat of a boundary retraction at Olympic National Park remains. However, the only measures relating to boundary adjustments introduced in Congress during the 1949 regular session were Senate and House concurrent resolutions, similar to those of last year, to establish a joint congressional committee to study and report on the matter.

Twelve years of regionalization.—August 1949 will mark the completion of 12 years of experience with regionalization of the activities of the Service. The four regional offices—in Richmond, Va.; Omaha, Nebr.; Santa Fe, N. Mex.; and San Francisco, Calif.—reflect, and are extensions of, the Washington office. Through them it is possible to bring the point of decision on many administrative matters closer to the field areas which they serve, and to provide needed professional services for which it would be impractical and expensive to staff the individual areas, and which could be furnished from the Washington office only at a tremendous cost in travel. In a few highly specialized professional fields, it is still necessary to provide direct service from Washington.

The necessity of regionalization resulted from the growth of the National Park System from a predominantly western institution to one which is actually Nation-wide in extent. Twelve years of it, under regional directors of competence and possessed of varied experience within the Service, has amply demonstrated its value both to the field areas, small and large, in the rendering of service, and to the Washington office, in relieving it of concern with a large amount of detail.

CONCESSIONS IN THE PARKS

The earliest concession operations in any national park were those in Yellowstone, established in the 1880's, and designed to meet the needs of a handful of travelers who reached the place with difficulty and who demanded none of the luxuries that the modern traveler counts as necessities. Since that time, with vast increases in quantity of travel and rapidity of movement, provision for the public has of necessity undergone an evolution designed to keep abreast of public demand and need. This evolution has been subject to definite limitations.

Chief among these has been that the Congress has never been disposed to appropriate funds to provide the basic "plant" of hotels, lodges, stores, and eating places. Thus, though a small fraction of the facilities of this sort now in the parks are, for one reason or another, Government-owned, it has been necessary to rely on private capital to make the necessary investment in plant; and this capital has been enlisted, during decades of changing conditions, with the primary object of meeting a public need on the best terms possible from the public standpoint.

Because the evolutionary process has not been based upon or resulted in a uniform policy; because of some inequities, from the standpoint of both the public and the concessioners; and because facilities had lagged behind need in the face of a phenomenal increase in visitors, the Director of the National Park Service, soon after the war ended, suggested that the situation be appraised, and recommendations formulated, by a qualified group of persons not connected with the Government. The basic questions upon which their advice was to be sought seemed to be these:

Should the Government now undertake to provide the basic plant, to be operated, as now and in the past, by individuals or corporations under contract?

If, though that were considered desirable, the Congress were not disposed to provide funds for such an investment, under what conditions can private capital be induced not only to continue operations but also to provide much-needed expansion? The question recognized that these conditions must be fair to the public, to the government which represents the public, and to the concessioners. In posing these basic questions, there was complete awareness that, in many of the parks, the pioneering days and the pioneering risks were largely past; that the parks had come of age and that providing for the public in them was "big business."

The Concessions Advisory Group, whose recommendations were briefly summarized in last year's report, attempted to provide the answers to these questions, on the basis of exhaustive study and analysis of every phase of the concessions problem. Secretary Krug's determination of policies, announced early in November, is directed primarily at the attainment of uniformity, the elimination of inequities, the encouragement of investment in additional facilities to the extent consistent with the public interest, and clear-cut definition of contractual obligations on the part of both Government and concessioner. Major points of clarification or of differences from previous policy relate to (1) control of the concessioner's rate of return on investment through the regulation of rates charged the public, (2) the method of levying franchise fees, (3) the procedure for negotiating and awarding new contracts covering concessions for which contracts have expired, (4) definition of the concessioner's equity in basic concession facilities, (5) a new definition of investment, (6) the inclusion in the contract of an option for Government purchase, and (7) the suggestion for the establishment of a Government-owned corporation to replace existing non-profit-sharing operating corporations.

Expansion and rehabilitation of public accommodations.—The rehabilitation of concessioners' plants to enable them to provide better service to the public has necessarily taken precedence over sorely needed expansion of accommodations. However, in a few places additional accommodations have been provided or are in prospect.

The Lake Hotel, closed for a number of years, is being completely rehabilitated and modernized. It will add 100 rooms, many of them with bath, to Yellowstone's present inadequate supply, together with dining room and kitchen facilities. Some 50 new cabins there, begun before the war, are now awaiting only the completion of new water and sewer connections. An automatic sprinkler system is being installed in the hotel. When it is completed, the Yellowstone Park Co. will have supplied this type of protection to all guest quarters more than two stories in height.

At Shenandoah National Park, the Virginia Sky-Line Co. completed an additional 10-room guest building at Big Meadows, and began building a new dining room and kitchen at Skyland, to replace one destroyed by fire. On the Blue Ridge Parkway a new gasoline station and coffee shop were put into operation at Bluff and a 24-unit lodging structure was nearing completion.

Two new cabins were begun at Bear Lake Lodge in Rocky Mountain National Park. At Yosemite National Park, additional tent and platform accommodations have been provided at Yosemite Lodge, a new store building and bathhouse have been completed at Camp 16, and a new 20-room employee dormitory is being constructed in the New Village area. At Zion and Bryce Canyon National Parks, bathrooms have been added to 40 standard cabins. The Utah Parks Co. has also done much other modernization and has provided new transportation equipment.

Practically all this rehabilitation and expansion has been accomplished by plowing back depreciation funds and profits into the business. This does not provide all the expansion that is needed, though more could be provided in this way but for the lack of appropriated Government funds to extend utility services to the expansion units planned by the concessioners.

Capital for expansion unobtainable.—Except for the limited amount which can be used from profits or depreciation reserve, funds for expanded facilities can be provided only in two ways: (1) By obtaining new private capital or (2) by the appropriation of Federal funds for the purpose. Concessioners have found it virtually impossible to obtain new capital at this time for expansion. Owners of risk capital display little interest in the investment prospects offered by national park concessions, where the seasons are short, the business subject to the vagaries of tourist travel, and the buildings must be built on Federal land under a contract term limited by law to 20 years, without what investors consider a satisfactory means of liquidating the investment at the end of the contract period. Furthermore, and even more discouraging to investors, building costs continue so high that prevailing rates for rooms and services will not permit enough profit for the investors to consider it worth the risk.

A new contract has been offered concessioners which offers inducements and safeguards to investment to the extent which it is felt that the Government can go, with the hope that new capital would be interested in investing in new facilities. Even that as yet has not attracted capital, however.

This situation has been explained to the House Committee on Public Lands, with the suggestion that, if the public is to receive the services enjoyed in the past, apparently the only way in which new facilities can be financed at many areas, is by providing Government funds for the purpose, with private individuals or corporations as operators under concession contracts. It has been further suggested to the committee that provision be made for the gradual purchase of the present concessioners' operating plants by the Government. Regardless of the method of expansion of accommodations, whether by public or private funds, adequate appropriations to build utilities, such as water, sewer, and telephone services, and roads to serve them are greatly needed. This has been recognized as the role of the Government, but needs caused by rapidly increasing travel have not been met.

Adjustment of rates.—Many reductions in rates to the public have been made with the object of limiting concessioner profit to a 6 percent average return on investment, as provided in the new concession policy. A few increases also were necessary. Reductions in the prices of some articles, notably souvenirs, resulted generally in increased sales volume with no decrease in profit and, in one case, in a noticeable increase.

Unaudited reports continue to increase.—Because of an insufficient staff, the number of unaudited annual reports increased during the year from 638 to 671. This is an unsatisfactory situation to which the Service has repeatedly drawn attention in making its request for appropriations. Regional auditors have been assigned to each of the four regional offices, but they have been forced to spend much of their time on urgent concession administrative matters. If the provision in the pending Interior Department Appropriation Act for four regional chiefs of concessions is approved, the auditors will be released for full-time audit work. A Senate amendment adds $100,000 for a temporary auditing staff to work on back audits, but a larger permanent staff is badly needed. This work must be brought up to date, and kept current thereafter.

The Loeffler contract.—Considerable public attention and much critical newspaper comment has focused on the contract under which the S. G. Loeffler Co. operates the public golf courses in the District of Columbia on National Capital Parks lands. This was the subject of hearings before a subcommittee of the House Committee on Public Lands on March 29, May 2, and June 8 and 9.

Announcement that the expiring 5-year contract for operation of the golf courses was to be renewed by the Department in order to permit the concessioner to recover his considerable investment of earnings in facilities, brought a protest from the District of Columbia Recreation Board. Discussions with the Board 5 years previously, looking to the possibility of their operating the courses, had been without result, because of their refusal to accept the Department's rules and regulations. Following audits of the Loeffler Co.'s books by both the Service and, later, at the request of the subcommittee, by personnel from the General Accounting Office and discussion of many elements of the operation in subcommittee hearings, negotiations are again under way for a transfer of responsibility for the golf course operations to the Recreation Board.

Negotiation of new contracts difficult.—A new contract, for the operation of concessions at Zion, Bryce Canyon, and Grand Canyon (North Rim) National Parks, has been made with the Utah Parks Co. for a term of 20 years which began on January 1. The company has agreed to expand accommodations as they may be required.

In August, the Department released a list of 19 contracts which had expired or would expire by December 31, 1949, and invited proposals for taking over and operating the concessions. The response was slight and mostly by persons with little capital to invest. Where no other proposals have been received, negotiations are under way with old concessioners who have given satisfactory service. The inability of concessioners to finance needed expansion is the major difficulty in current negotiations.

At Lassen Volcanic National Park, the Lassen National Park Co., which has accepted an extension of its contract to May 1, 1950, has advised that it cannot enter into a new contract, due to inability to finance new developments. Consequently, a new concessioner is being sought who will be able to furnish the service required.

Negotiations are under way for the studio concession of Haynes, Inc., and the Hamilton bathhouse concession at Yellowstone, the Glacier Park Transport Co. at Glacier, and the Mountain Observatory and Lamar Bath House at Hot Springs.

No action has been taken by the Congress on legislation which would authorize Government purchase of the assets of the Rainier National Park Co. The endeavor to interest others in buying these facilities and providing additional accommodation has been unsuccessful. However, service has been continued by the company, by an extension of its contract to December 21, 1949.

Such further action as may be possible will be taken on other expiring contracts before the end of the calendar year. The smaller concessions which require little capital investment will be covered in the future by business concession permits, rather than contracts.

Concession labor regulations changed.—New regulations governing the conditions of employment for concessioners employees, issued by Secretary Krug to become effective January 1, 1949, changed previous regulations to provide (1) a minimum wage of 40 cents an hour, (2) time-and-a-half pay for all time over 40 hours a week, instead of time-and-a-quarter for all over 48 hours a week, (3) application of State labor law standards wherever they are higher than those of the Department, and (4) elimination of regional wage boards.

Following hearings, the new regulations were modified to provide (1) time-and-a-quarter pay for work in excess of 48 hours during 1949, (2) time-and-a-half for over 44 hours per week during 1950 and 1951, and (3) time-and-a-half for over 40 hours per week beginning January 1, 1952.

DEVELOPMENT PROGRESS LIMITED

For the 1949 fiscal year, the National Park Service received appropriations of $1,652,350 for physical improvements, $3,110,000 for roads and trails, and a contract authorization for parkways amounting to $2,680,000. Of the first sum, $115,000 was allotted for rehabilitation of structures and utilities that had fallen into disrepair during the war; of the second, $2,500,000 was allocated to maintenance of roads and trails. Most of the remaining funds are being used to further the progress of projects started but not completed prior to the war.

The backlog of needed physical improvement projects throughout the National Park System has pyramided to an estimated cost of $140,000,000, of roads and trails projects to $175,000,000, and of authorized parkways to $181,000,000. Thus the estimated present needs for development come to a total of $496,000,000.

Though handicapped by the necessity of spreading 1949 funds for physical improvements over a large number of areas and, consequently, by inability in many cases to contract for whole projects at one time—a costly handicap—or even to interest contractors because of the smallness of individual projects, the year has brought a few significant and encouraging advances. The largest single project under way is that at the Statue of Liberty National Monument, for which $500,000 was earmarked by Congress. The improvements at this area are well started. Five construction contracts have been completed or are in progress. These involved grading, building obliteration, installation of a heating system in the statue, storm drainage, and fabrication of interpretive devices. The present program will be augmented by the allotment of additional funds in 1950 primarily for work at the west landing and the turning basin. With substantial completion of all these, the appearance of the monument—so long and regrettably an eyesore—will be greatly improved.

Field studies, surveys, and plans have been in progress throughout the year for projects which will be programmed for construction in the fiscal year 1950 and later. Meantime, most of the undesignated balance of physical improvement funds has had to be used for rehabilitation of existing facilities elsewhere in the system. These funds have been used on a wide range of small but greatly needed projects such as campground, picnic, and beach developments or improvements; the installation, extension and replacement of worn-out or inadequate utilities systems; comfort stations; ruins stabilization; and employee housing of both permanent and temporary character. Thus acute needs have been somewhat alleviated in some of the areas.

Communications systems.—Throughout the system, protection is seriously handicapped by the lack of adequate internal communications. However, real progress was made in improving the situation for the system as a whole. At a cost of $29,456 of physical improvements funds for the purchase of radio equipment, FM systems were installed in Everglades National Park and along the Blue Ridge Parkway, and a radio telephone system was set up at Mount Rainier National Park.

In addition, the Service obtained from surplus a large amount of communications equipment, valued at $225,000, and placed it in operation. The carrier telephone equipment now in use at Mesa Verde and Glacier National Parks, and in the Region Three office at Santa Fe for communication with the southwestern national monuments, was so obtained. Surplus radio equipment has also been shipped to Tupelo for communication along the Natchez Trace Parkway. Plans for the extension of Olympic National Park's communication system were completed.

Administration will be greatly facilitated by the two-way radio communication service established between Hawaii National Park headquarters at Kilauea, on the Island of Hawaii, and the Haleakala section of the park on Maui. On-the-spot reporting of the eruption of Mauna Loa, which began on January 6, was made possible by portable radios installed at the summit.

Progress made on road jobs.—Unlike 1948, when labor and materials were scarce and bids on road jobs inordinately high, the Service has been able to enter into favorable contracts for 10 essential road construction projects during 1949. However, slightly less than

$1,000,000 of roads and trails funds were available for new construction.

Construction projects were launched in Colonial National Historical Park and in Great Smoky Mountains, Shenandoah, Yellowstone, Rocky Mountain, Zion-Bryce Canyon, Yosemite, and Sequoia and Kings Canyon National Parks. In addition, a day-labor project was started on the Loop Highway in Lassen Volcanic National Park under Bureau of Public Roads supervision.

These contracts and the day-labor job consumed all the available roads-and-trails construction funds except $132,000 which had been earmarked by Congress to construct part of the Heintooga Road in Great Smoky Mountains National Park. This sum was insufficient to cover any contract that would not cost inordinately for the amount of work that could be accomplished. It was, therefore, deferred until enough additional money could be made available to permit construction at reasonable cost.

Maintenance of roads and trails.—Estimates indicate an average cost of $571 per road-mile for maintenance of roads in the National Park System, approximately 75 percent of the national average. For trails the figure is $59 per mile. Of the total available roads and trails funds, it was possible to apportion only $320 per mile for road maintenance, and $42 per mile for trails. Consequently, not all roads and trails in the system could be given even routine maintenance; and much old equipment, long past economical operation, had to be kept in service for another year, with attendant high operating costs.

A result of this situation is that the public is not served by adequately maintained roads and trails. And the ultimate cost is higher; necessary reconstruction, which could be postponed for many years if proper care could be given year after year, is greatly increased.

In order to meet this situation more realistically, a maintenance program, based upon the expectation of increased roads and trails funds in the 1950 appropriation and in subsequent years, has been evolved on the following basis:

(*a*) A 5-year program for liquidating the backlog of war-deferred special maintenance items before they reach the reconstruction stage has been established. This calls for the expenditure of $3,500,000 in 1950, and increases annually to $3,900,000 in 1954. Thereafter, with the deferred items liquidated, funds for this program can be reduced. It will then be possible to establish a preventive maintenance program on an annual routine basis. Such expensive items as resealing, reprocessing, and vista clearing will be programmed regularly for sections of highway, rather than be allowed to accumulate by whole routes and whole areas, as they have had to be in the past.

(*b*) An equipment amortization program which will provide more adequately for equipment requirements than has been possible in previous years has been established for 1950.

Maintenance funds have to be spread out over 5,215 miles of heavily used roads and over more than 7,000 miles of trails in the National Park System.

Parkway construction moves ahead.—Although the 1949 appropriation act contained no appropriation for parkways, it did include a contract authorization of $2,690,000. This, with balances remaining in parkway funds, provided the Service with a program of $9,796,000, of which more than $8,000,000 was allocated to the road program of the Bureau of Public Roads. Slightly less than $1,000,000 of the balance was available for roads and trails and physical improvement projects handled by the Service itself. Work was under way or completed on 94 such projects. Blue Ridge Parkway projects completed under the latter program included the gas station and coffee shop at Bluff Recreational Area, and the Peaks of Otter bus terminal, starting point for the Sharp Top bus trip.

Lack of title to right-of-way for the Gatlinburg Spur connection held up construction on the Foothills Parkway, in Tennessee. On the Natchez Trace Parkway, lack of right-of-way in both Mississippi and Tennessee has held up construction of three grading projects. Because 1949 funds for the Tennessee portion were earmarked in committee, almost a million dollars which might have been put to use on other parkway jobs has lain idle.

On the Blue Ridge.—The completion of a paving contract in the fall of 1948 opened up a unit of 47 miles from Rock Fish Gap south to U. S. Route 60, so that the motorist can now travel 155 miles on continuous paving, including the Skyline Drive in Shenandoah National Park. In North Carolina, completion of 30 miles of paving offered 53 miles of surfaced road south from Blowing Rock to the newly built State road to Mount Mitchell at Swannanoa Gap. The completion of grading and construction on one section sometime during the present fiscal year will open up a long unit of the parkway and give access direct to the city of Asheville by way of North Carolina Route 694. Only one short stretch of 5 miles, for which funds are not available, remains to be built to connect with U. S. Route 70 at Oteen, 4 miles north of Asheville.

Along the Natchez Trace.—Fifteen bridge and overpass projects were either completed or under construction during the 1949 fiscal year. The opening up of a 58-mile unit from Ridgeland, just north of Jackson, Miss., northeasterly to Kosciusko, awaits completion of several of these structures. Three grading projects which are expected to be finished sometime this summer will connect the unit north of Jackson with a previously graded section north of Kosciusko. Additional funds are needed for paving these several units. When that is done, it will be possible to open to public use a continuous section of 90 miles.

The George Washington Memorial Parkway.—The principal work on this parkway, which parallels the Virginia shore of the Potomac River, was the grading of a connection between Key Bridge and Lorcom Lane, approximately 1 mile which, when paved, will greatly facilitate traffic connections between the parkway and the Lee Highway in Arlington County.

Parkway summary.—For all parkways, major road projects costing $2,565,200 were completed; others to cost $7,771,400 were under construction.

Storms cause havoc.—Floods and the exceptionally heavy snowstorms of last winter caused unusual damage to roads and trails and to utilities and buildings in many areas in the National Park System and required the allotment of considerable amounts from limited funds for repair.

Flood damages in Glacier and Mount Rainier National Parks; the removal of down timber from Mount Rainier roads; the restoration of flood-damaged trails in Grand Canyon National Park and Bandelier National Monument; repairs to bridges in Acadia National Park; and repairs to roads and trails in Mammoth Cave National Park, Colonial National Historical Park and Catoctin Recreational Demonstration Area required special allotments amounting to $118,914.56. In five areas $22,560 was expended from reserves for unusual snow-removal operations in addition to the normal allotments. A special allotment of more than $68,000 had to be made for repairs to buildings and utilities damaged by storms.

Surplus property transfers assist the Service.—The National Park Service continued to benefit from the authorization contained in Public Law 841 to acquire surplus roads and trails equipment and materials and supplies, without exchange of funds, from the National Military Establishment and the War Assets Administration. During the year, the value of such transfers exceeded $322,000.

While these transfers have been of help to the Service at a time when it had little money to expend on the replacement of outworn equipment or of equipment which was commandeered by the military authorities at the outbreak of the war, the condition of that received from surplus was, for the most part, only fair and it has been difficult to obtain replacement parts which most of them needed to put them in repair. For the efficient and economical performance of maintenance and repair activities, early replacement of most of the equipment in use throughout the National Park System is urgently needed.

Soil and moisture conservation.—During 1949, with an allotment of $95,000 from the Department's Soil and Moisture Conservation funds, work was carried on in 13 areas, most of which are situated in the South and Southwest, but substantial increases in the number and scope of surveys, erosion-control plans and projects are needed. To bring erosion under control on areas where that is needed, to a point requiring thereafter only normal maintenance, it is estimated that about $300,000 a year should be expended on this work over the next decade. Funds made available to the Service since the Department's program was started in 1951 have averaged only $50,000 a year.

On historical areas, where it is desirable to maintain open fields to display conditions approximately as they were at the time of the historic events commemorated, soil and moisture are being conserved through agricultural use, under permits that require sound handling of the land and the constant enrichment of the soil.

A total of 655 revocable permits for various uses of Service-administered areas were approved during the year. One of unusual interest was issued to the Coast Guard for rehabilitation and use of the old lighthouse at Cape Hatteras. This fine structure was abandoned in the early thirties because of the close encroachment of the ocean. However, due at least partly to the program of sand fencing carried on along the North Carolina barrier islands over a period of several years under National Park Service direction, the sand area has now built up to a sufficient distance from the base of the light to make it safe to resume its use.

THE EDUCATIONAL FUNCTION OF THE NATIONAL PARK SERVICE

Congress, in authorizing the establishment of the National Park Service, enjoined it to provide for public enjoyment of "the scenery, the natural and historic objects and the wildlife" in the areas entrusted to its care. This is a positive injunction. Though the laws insisted that these areas were to be so managed that their qualities should remain unimpaired, their justification lay in their capacity to provide enjoyment, in its best sense, now and in the future. The function of preservation and protection was a means to that end and not an end in itself.

The essential task of the National Park Service, then, is to see to it that the American people shall have the opportunity to obtain the maximum beneficial use and enjoyment of the kinds which derive from the character of the park areas themselves; enjoyment which at the same time involves the minimum of change in the natural or historic scene which the Service is required to conserve.

To meet that responsibility requires much more than the provision merely of access and shelter. It involves more than satisfaction to the physical senses through the experience of outdoor life in a beautiful setting. It places on the Service the obligation to contribute to a deeper understanding of natural processes and historical events about which any intelligent human being has a natural and legitimate curiosity.

It is education.—Because the word "education" popularly connotes a somewhat formal process, one hesitates to use it in referring to a function of a Government bureau like the National Park Service. Nevertheless, in its sense of "leading out" people of all ages to a fuller comprehension of the world they live in and their place in it, education is a part of the Service's job, and its contribution to beneficial and lasting enjoyment is as great as that of any activity in which the Service is engaged.

When the visitor to Yosemite asks the man in uniform how that stupendous valley was formed; when he stands on the Rim of the Grand Canyon and wants to know how long it has taken the muddy Colorado to work its way down through a mile of rock; when he climbs to the terreplain of the Castillo de San Marcos and seeks to learn just what was the purpose of that ancient fortification; when these questions are multiplied by thousands and the Service must satisfy them or be convicted of doing its job inadequately, then it is in the business of education "up to its neck." It couldn't get out of it if it wanted to—which it doesn't.

The Service is then, in a sense, an educational agency. Its intent is to do its educational job well. If this work—which has come to be called its "interpretive program"—is to be effective, it must be enjoyable; it must be informal; it must stimulate as well as satisfy healthy curiosity; it must widen the mental and spiritual horizons of those who take advantage of it. Equally, to attain these ideals, the Service must have adequate and qualified staff, and adequate physical equipment. This equipment must reflect modern education progress as, for instance, in the effective use of visual materials.

A corollary product of this program is bound to be a more thoughtful and intelligent regard for the worth of the parks themselves. This will undoubtedly lessen the carelessness and vandalism which so seriously trouble the administrators of all kinds of public reservations.

The Service is constantly adopting new methods and techniques in its effort to meet the tremendous demand, but it can scarcely claim to be doing the job that the public expects of it with full effectiveness. Both staff and physical equipment are overwhelmed by, and woefully inadequate for, the requirements put upon them. Museums are needed in many areas. These are not, and should not be, places where miscellaneous collections attract the idly curious. They should rather contain carefully selected and effectively presented items that contribute to better understanding of the areas in which they are situated, and of the National Park System of which those areas are a part. In all but a few areas, our museums are either outgrown or nonexistent, or they represent an effort to tell a story with crude or inadequate tools.

In other phases of interpretation, there is serious loss of effectiveness because of the day-after-day overload on staff members. On guided trips, the number of visitor participants per naturalist or historian tends to be several times as great as can be satisfactorily served. In such places as Carlsbad Caverns, or Mammoth Cave, this loss of effectiveness is complicated by the fact that control of the visitor, to prevent damage to delicate natural formations, is made difficult or impossible.

In many cases, the capacity of existing facilities is far below the present-day requirements. For example, at the Yavapai Observation Station, on the South Rim of the Grand Canyon, scene of perhaps as striking and effective an example of interpretation as is offered anywhere in the National Park System, the space is so seriously overtaxed as to cause discomfort and justified dissatisfaction.

Despite handicaps, progress during the year just past has been notable in many respects. The public reaction has been highly gratifying, both in volume and in the quality of response to the efforts put forth.

In the scenic-scientific areas, attendance on 17,284 conducted trips totaled 1,037,648. Naturalists gave 15,195 talks, such as those given at Yavapai, mentioned above, or at evening campfire programs, and at these there was an attendance of 1,212,729. Individual contacts at information stations of various kinds came to a total of 4,060,334. Visitors who made use of unattended interpretive stations or devices totaled 4,658,284. In addition, about 10,000,000 persons visited the historical and archeological areas during the year; almost all made some use of interpretive facilities of one kind or another.

Museums.—In a typical park or monument, the museum is probably the most important element of the interpretive work carried on there, save only for competent personnel. It is the focal point about which the program revolves.

Two museum developments, both completed before the end of the fiscal year, have made an exceptionally favorable public impression. A completely new and effective museum exhibit at Manassas National Battlefield Park was opened to the public on May 28. The general public has given evidence of its interest by doubled visitation during the months since the opening; and such students of the Civil War as Dr. Douglas Southall Freeman and Otto Eisenschimmel have praised the new display with enthusiasm.

Manassas presents an acute problem of interpretation, since it is the site of two major battles, and since the small park staff cannot provide enough personal service to explain the complicated story. Yet the visiting public want to know. The new museum is designed to meet this particular situation; to present the facts fairly and impartially, but in vivid and striking fashion.

The new permanent museum exhibits at Guilford Courthouse National Military Park, thrown open to the public on July 4, 1949, were virtually completed before the end of June. These exhibits are of the same effective quality as those at Manassas.

In both museums are striking dioramas. That at Manassas portrays a tense and dramatic moment during the first battle; that at Guilford shows the final charge of William Washington's cavalry and the First Maryland Infantry at the height of the battle.

At Kings Mountain National Military Park a modern museum was built and most of its exhibits installed before World War II. These installations have now been completed. Since the park has no historian, the electric map, which visitors can operate themselves, helps them to grasp the story of the American pursuit and the British retreat which ended at Kings Mountain. The Jackson wing of the Museum at Scotts Bluff National Monument was nearing completion at the end of the year. There preparations were under way for the installation of a series of paintings by the late William H. Jackson portraying the Oregon Trail and typical scenes of the migration which followed it a century ago, donated by the American Pioneer Trails Association. Since the Oregon Trail is now largely traversed by modern highways, it is not easy for the modern traveler to visualize conditions during the emigration, but this fine series of paintings will undoubtedly help to make them vivid and real.

During the year several other individuals and organizations donated funds, exhibits, and skilled assistance to the Service for museum development. Hui-O-Pele, an organization whose funds are derived from $1 membership certificates sold to Hawaii National Park visitors, has earmarked up to $10,000 for exhibits for the park museum. The Avalon Foundation gave an additional $40,000 for the development of the mansion at Hampton National Historic Site as an historic house museum. The New York Chapter, Colonial Dames of America, donated antiques valued at $10,000 to furnish the upper floor of the Ford Mansion, at Morristown National Historical Park. A staff member of the California Academy of Sciences generously donated his time and skill to the cutting and polishing of more than 100 pieces of petrified wood for the museum at Petrified Forest National Monument.

The Islesford Museum on Little Cranberry Island, Maine, which contains the valuable collection and library on the history and culture of the Mount Desert region assembled by Prof. Wilkin O. Sawtelle, was added to Acadia National Park by gift.

Preservation of the valuable scientific and historical collections of the various park areas remains a museum problem of increasingly serious concern. The Gettysburg cyclorama was given emergency treatment to arrest its deterioration, and special study was given to the deterioration of rare fabrics at the Vanderbilt Mansion. A survey has been started to determine the collections in the most urgent need of safe storage and preservative treatment.

Exhibits for park museums are prepared in a central laboratory, so that even the smallest and most isolated museum has the advantage of a skilled staff of curators and preparators. Centralization of this sort of work not only permits the production of a high quality of exhibits that would otherwise be impossible but is far more economical than any other possible method.

Guided trips.—Trips, afoot or by automobile caravan, guided by qualified naturalists or historians, are offered in a large number of areas. These offer a fine mental stimulation with a large dividend of spiritual values, pleasantly combined, in the case of walks, with mild physical exertion. Each year sees constantly greater numbers of visitors participating in them—added proof that visitors are hungry for knowledge of what the parks contain. Too many participants per guide impairs the effectiveness of these trips. At Yellowstone National Park, for example, attendance on guided trips often exceeds 150 per naturalist. Even when he is equipped with a megaphone, he finds it difficult to make himself heard. At times there is confusion and crowding, endangering the formations in the geyser basins, and also endangering the people. Where catwalks have been provided, it is virtually impossible to confine such large groups to them. It is also impossible effectively to prevent acts of vandalism, such as marking the formations or throwing trash in the pools.

At Mesa Verde, on trips during which parties enter a ruin such as Spruce Tree House, there should not be more than 40 persons under the guidance of a single naturalist; yet there are frequently as many as 100, compelling serious consideration of further measures to restrict access. Many people find the experience of entering an ancient dwelling memorable and thrilling, so that the Service adopts restrictive measures with reluctance and only when they are unquestionably necessary.

Campfire programs and lectures.—Evening campfire programs, an established institution in many of the national parks, serve several purposes. While the primary purpose may be to inform, they are important also in providing something pleasant and interesting to do during the evening. Their informal character and the fact that, in many places, group singing is the opening feature, is valuable in establishing a relationship of confidence between the audience and the participating Service personnel. It provides a fine opportunity to make park visitors aware of the many-sidedness of the interpretive program, to inform them of the purposes of the National Park System, and to enlist their cooperation in protecting it. Audiences at these evening programs and at analogous daytime programs were almost without exception greater than during any previous year.

Making a virtue of necessity.—In order to widen the scope of the program, and to reach more people than can be served directly by the interpretive staffs, the past year has seen considerable experimentation in the development and use of self-operating interpretive devices.

The increasing numbers of visitors to the Lincoln Museum, in Washington, D. C., made it necessary to install a magnetic tape recording of the talk on Lincoln, with an automatic slide changer, since staff members could not repeat the talk as frequently as demanded. Self-operating electric maps and automatic slide changers have been installed at Manassas National Battlefield Park, and at Guilford Courthouse and Kings Mountain National Military Parks.

In Lassen Volcanic National Park, mutilation of trail signs and theft of markers caused the development of three nature trails along which the outstanding features were each marked only by a number. The corresponding number and the scientific interpretation of the feature were then incorporated into an information leaflet. The leaflets, produced with contributed funds, were made available at a bulletin board at the beginning of each trail. Similar trails are in use at Mount Rainier National Park, at Gran Quivira and Walnut Canyon National Monuments, and at the detached Montezuma Well section of Montezuma Castle National Monument. Natural history associations at Lassen and Mount Rainier and the Southwestern Monuments Association have supplied the funds for the leaflets on which these devices depend.

These methods of providing information are without question useful, but they are definitely inferior to services provided direct by competent and interested personnel. The information given is of necessity limited so that not all the questions which naturally arise in connection with their use are answered. Chiefly, however, they are "cold," and incapable of evoking the kind of response so frequently and happily aroused by a person full of his subject, enthusiastic about it, and capable of kindling enthusiasm in others.

Studies of interpretive activities.—Three excellent studies which analyze and appraise park interpretive activities were made during the past year by university research students. All three studies recognize the public need for understanding, the contribution of the interpretive programs to heightened enjoyment and better use of the parks, and their influence in reducing misuse and vandalism. All point to inadequacies of personnel as serious handicaps to the accomplishment of these objectives.

The printed word.—Attractive, reasonably comprehensive and carefully edited printed matter is essential to knowledge and enjoyment of any individual park or historical area. The past year saw a constant improvement in the quality of the literature available alike to visitors and other inquirers. For its exceptionally attractive appearance, the Service is greatly indebted to the design staff of the Government Printing Office.

During recent years, it has been necessary to practice the utmost economy in connection with this publications program, through reductions in size and limitation of quantities. In many instances, funds have not been sufficient to permit production of sufficient numbers of copies. Removal of the limitation on printing and binding in the pending 1950 appropriation act, which has been a severe handicap in the past, is expected to make it possible to provide sufficient publications to meet legitimate public demand. The supplying of quantities of publications to automobile clubs, travel bureaus, and other outside agencies must, however, continue to be subject to strict limitations. For the system as a whole, an adequate annual production of publications will come close to 10,000,000 pieces.

Launched on a modest scale during the past year was a program of replacement of the series of 16-page sales publications on historic and archeological sites with a new series of handbooks in a smaller, more attractive format and with more comprehensive content. A few other sales items were included in the year's program.

Natural history associations and analogous "official cooperating organizations" continued to fill in the gap caused by the insufficiency of appropriated funds for printing, by producing a number of distinctive and valuable interpretive publications. The proceeds from the sale of these association publications are utilized in various ways to assist the interpretive programs in the parks.

PROGRESS IN THE HISTORICAL FIELD

Ancient Spanish forts made national historic site.—The establishment of the San Juan National Historic Site, Puerto Rico, was one of the most gratifying developments of the past year. Included in it are the gigantic fortifications of El Morro, on the outer point of the island of San Juan; San Cristobal, rising high above the northern shore of the island less than a mile away; the Casa Grande; the fortified walls connecting El Morro and San Cristobal and extending around the harbor side of the island; and El Canuelo, on a former island, now a peninsula, across the harbor entrance.

The status of this site is unique. Primary jurisdiction over it is retained by the Department of the Army, which continues to use it for military purposes. The agreement between the Departments of the Army and the Interior, which provided the necessary basis for the site designation, gives the Service responsibility for the interpretive program and the handling of visitors and for advising the Army on the preservation and restoration of the fortifications.

Preserving historic structures.—Noteworthy progress in repair and stabilization of historic structures can be recorded for the year. At Castillo de San Marcos National Monument, in Florida, the footings of the fort walls were stabilized, the walls repointed, and the old tide gates to the moat found and measured drawings made of them. The historic Ford Mansion at Morristown National Historical Park underwent structural rehabilitation and painting. Generous additions to the funds originally donated for "Hampton," supplemented by still other funds to match other donations, have made possible the extensive repair and rehabilitation in progress at Hampton National Historic Site.

Stabilization and protection work were completed at Fort Matanzas, Fla., last March. Various prehistoric adobe structures in the Southwest were stabilized, as part of the continuing program of such work in these areas, for which highly skilled workers have been developed.

Following close upon the establishment of the San Juan National Historic Site, plans have been made for the preservation and repair of the historic fortifications, oldest masonry structures under the American flag. The Department of the Army has indicated deep interest in this work and will seek funds with which to carry it on. Much of it is very greatly needed to prevent even more serious damage.

The restoration of the McLean or Surrender House at Appomattox Court House National Historical Monument was completed just too late to permit dedication on the 1949 anniversary date of Lee's surrender. This is now planned for April 9, 1950.

In connection with the project for preserving and cleaning the frescoes of the ancient mission at Tumacacori National Monument, the Service was fortunately able to obtain advice and assistance from an outstanding authority, Dr. Rutherford G. Gettens of the Fogg Museum of Art, Harvard University. Guided by his recommendations, Tumacacori's fine old frescoes and plaster work are being cleaned and restored.

A beginning has been made also on the repair and rehabilitation of the Perot-Morris House in Germantown, Pa., recently donated to the United States by the heirs of the Morris family, which has owned it since 1934. Mrs. Elliston P. Morris of Philadelphia has generously left on indefinite loan, for display there in connection with its operation as a house museum, handsome suites of period furnishings. The house will be a part of the Independence National Historical Park. It will be operated, however, by the Germantown Historical Society.

Archeology on historical areas.—The methods of archeology, applied to historical areas, continue to produce gratifying results in several Service areas. The outlines of the fort built by the "lost colonists" at Fort Raleigh, N. C., were definitely established. Excavation of the site of the first house and the main mission house, at Whitman National Monument, has been completed, and work on other excavations is continuing. The house occupied by Dr. John McLoughlin, chief factor of the Hudson's Bay Co. and the priest's house are among the buildings which excavation at the Fort Vancouver National Monument Project has uncovered and identified. There 40,000 artifacts have been uncovered.

Excavations at Glass House Point, on Jamestown Island, uncovered unmistakable evidence that the early settlers there undertook the working of glass soon after the colony was established. The remains of four furnaces, and of ashes, clinkers, crucible pots, and pieces of glass were uncovered.

Service cooperation with historical conservation groups.—The National Park Service continues to participate in and encourage the efforts of nongovernmental agencies in the preservation of sites and objects of historical importance. The work of these agencies is important since many sites, for which the Federal Government cannot and should not assume primary responsibility, deserve protection.

Late in the summer of 1948, the National Council for Historic Sites and Buildings, of which the Director of the National Park Service is an ex-officio member and the Service's chief historian is secretary, established an office in Washington, D. C. A major objective of the council, which brings together the forces of 36 national organizations and agencies, is the establishment of a national trust for historic preservation in the United States, to be modeled on the English national trust, but adapted to the principles of American law. Toward this objective, the Service has given advice and assistance, while the Department has sponsored the introduction of authorizing legislation in the present Congress.

In June, the Service, Colonial Williamsburg, Inc., and the American University jointly sponsored and participated in an Institute in the Preservation and Interpretation of Historic Sites and Buildings. The institute brought to Washington and Williamsburg students from such faraway places as Florida and California. The

Service was also asked for, and gave, advisory assistance to the Thomas Jefferson Birthplace Memorial Park Commission, which had purchased the "Shadwell" estate on which Jefferson was born. This purchase is typical of what private and local historical groups are undertaking.

Archeological and paleontological research.—Fourteen reputable scientific-educational agencies conducted 16 separate field research programs on Federal lands during 1948 under Antiquities Act permits granted by the Secretary of the Interior. Findings included evidence of the earliest known type of American dwelling (3000 to 2000 B. C.), in California, and the earliest known ancestor of Indian maize, a diminutive pod corn dated about 2500 B. C., in New Mexico.

Five national monuments and one national park are included among the areas on which 28 research programs were scheduled for this summer by 13 universities, 1 college, and 7 museums.

Increasingly effective enforcement of the provisions of the Antiquities Act can be noted. Dr. Jesse L. Nusbaum, archeologist in the Region Three office in Santa Fe, also serves as consulting archeologist for the Department. In that capacity, he checks the plans and the qualifications of research groups and investigates reported violations of the Antiquities Act.

Theodore Roosevelt National Memorial Park dedicated.—Sponsored by the Greater North Dakota Association, a State-wide organization of chambers of commerce and business and professional men, the dedication of the Theodore Roosevelt National Memorial Park on June 4 was notable in a number of respects. It was held in a natural amphitheater with the picturesque Badlands as a backdrop; it attracted an estimated 25,000 persons; a half-hour of the program, during which Representative William Lemke and Senator Milton Young, both of North Dakota, and Secretary Krug and Director Drury were speakers, was carried nationally by the National Broadcasting Co. (reported to be the longest national broadcast ever to have originated in North Dakota); it was attended by an exceptionally distinguished group of special guests. Gov. Fred G. Aandahl of North Dakota acted as master of ceremonies for the entire program, which lasted an hour and 50 minutes, and was broadcast by six stations in North Dakota and Montana.

Supplementing the dedication program, a series of 11 scenes of North Dakota history was presented at as many points along the main road through the south portion of the park. The entire program was a credit to the association and evidenced the keen interest of the entire State and its neighbors in this unique and picturesque area, which so strongly influenced the career and the thinking of Theodore Roosevelt.

THE WILDLIFE OF THE NATIONAL PARK SYSTEM

In the national parks, all forms of wildlife are, in theory, left to shift for themselves. This laissez faire method of management—or nonmanagement—would probably be wholly practical in very large areas in which there was a proper balance of seasonal range and of favorable habitat in which normal relationships had not been much disturbed. However, such conditions cannot be said to exist in any national park, no matter how extensive. Each is affected by human influences, past or present; normal winter range has been taken over by grazing or agriculture; some predator species have been reduced in numbers; any of a number of processes have disturbed natural relationships in such fashion that positive management is occasionally required. This is undertaken to keep relationships from getting so far off balance as to threaten the extermination of a species, directly or indirectly.

In Yellowstone National Park the increasingly serious problem is one of winter range for the great elk herd which frequents the northern part of the park. Herd reductions have not been sufficient to halt the depletion of the important browse species on which it relies for food. It is estimated that the elk will number 11,000 this fall and that the winter range will not support more than 5,000 if its condition is to have a chance to improve materially. Refusal of the Montana State Game Department to permit hunters to harvest enough elk north of the park leads only to the conclusion that, to save the remaining range and the associated wildlife, the Service itself will be forced to effect a drastic reduction.

In the east-central part of Rocky Mountain National Park, immense changes have been and are being wrought in the vegetation by too numerous mule deer and elk. A reduction of about 75 percent of these animals is necessary to permit the range to recover. Plans to initiate this reduction last winter were canceled because of local objections to the disposal of the carcasses to needy Indians.

On much of the periphery of Glacier National Park, mule deer and elk have insufficient winter food. Experiments with salt to entice the elk from the park to open hunting territory offer some possibilities for at least a partial solution of the problem along the west side of the park.

In Zion National Park controlled killing of mule deer was continued to restore the vegetation in Zion Canyon. There, shrubs once seriously damaged show much improvement. On the plateaus east and west of the canyon, however, destruction of range continues unchecked. Most of the animals responsible are available for hunting, during the season, outside the park; but the surrounding region is sparsely populated and the light gunning pressure has no appreciable effect.

Black bears still present a dangerous problem, mainly visitor-caused, in Yellowstone, Glacier, Yosemite, Sequoia, and Great Smoky Mountains National Parks. Despite repeated warnings, a small minority of visitors persist in feeding these animals. The number of injuries is remarkably small, but traffic is often snarled along heavily traveled roads and accidents result from the congregation of visitors around "roadside" bears. Their appetites for artificial foods whetted by promiscuous feeding, some of these animals make serious nuisances of themselves by breaking into buildings and automobiles in search of food.

Encouraging developments.—Several parks established in recent years have included lands long settled, in which many species once numerous there had been depleted or had disappeared. The Service practices or encourages restocking when it is possible to obtain stocks of the subspecies formerly found in these areas. Several efforts at restocking during recent years have had encouraging results. During the past 2 years, with the cooperation of the Kentucky Game and Fish Division, 36 whitetail deer have been released in Mammoth Cave National Park. These animals have ceased to roam widely and are reproducing. The park administration also obtained four pairs of ruffed grouse of the native subspecies and released them in excellent condition. These birds have been rare, or possibly extinct, in the park and its vicinity for many years.

The Service is indebted again to the Texas Game, Fish, and Oyster Commission for an additional stocking of antelope in Big Bend National Park. The bands now in the park total about 100 head.

The Rocky Mountain bighorns released in Mesa Verde National Park several years ago have prospered, apparently, as several lambs have been produced. The band ranges widely and does not remain within the park.

Other rare species.—The first seen in some years, two grizzlies were sighted in Grand Teton National Park during the summer of 1948, and other signs of them were observed. Two rare animals, the wolverine and the fisher, seem to be increasing in Sequoia and Kings Canyon National Parks. A survey of the Sierra bighorn in those 2 contiguous parks revealed about 200 animals, though it is possible that the population is twice as great.

Dall sheep, in Mount McKinley National Park, after having reached a disturbing low, are definitely on the increase. Trumpeter swan in Yellowstone National Park and contiguous territory appear to be, also. An aerial census revealed at least 49 adults and 13 cygnets in the park, and 8 adults and 4 cygnets on nearby waters to the south. The sight of 5 nene or Hawaiian geese on Mauna Loa, in Hawaii National Park, has raised hopes that this rare bird may become reestablished there. To relieve destruction of vegetation there and to aid wildlife, the park staff destroyed, during the first 10 months of the year, 3,006 goats, 261 pigs, 44 mongooses, and 4 feral house cats.

Poaching.—Illegal destruction of wildlife continues to be serious in a number of areas. Poaching, together with natural losses during the blizzards last January, reduced the Wind Cave National Park antelope to the lowest number during the past decade. The marked scarcity of goats, deer, and hair seals in Glacier Bay National Monument, where the Service has no protective staff, is ascribed largely to poaching.

Fishery management.—Approximately 5,132,000 fish, including 2,170,000 eyed eggs, were planted in the waters of 16 areas. Practically all of the eyed eggs were placed in Yellowstone National Park waters.

Two fishery problems are causing much concern. Because of the pressure of numbers, many popular fishing streams and lakes have been depleted of the larger fish, and anglers are dissatisfied. Stocking of legal-size fish is highly expensive and is unsatisfactory in national park areas for several reasons. It is becoming apparent that, to protect the streams, angling pressure must be restricted within the rather limited natural carrying capacity of the mountain waters.

The second problem is that of overfishing by commercial interests in Florida Bay, much of which is ultimately to be a part of Everglades National Park. Not only is future commercial and sport fishing endangered there by destructive methods of fishing; the food supply of many kinds of aquatic birds—ibises, herons, roseate spoonbills, cormorants, pelicans, and others—which are dependent on a continued supply of small fish and other aquatic life, is being seriously depleted. Florida Bay needs to be added to the park, and proper protective regulations established and enforced, at the earliest possible moment.

PROTECTION OF PARK FORESTS

Fire control.—Except for 1944, the calendar year 1948 witnessed the smallest number of forest fires in the National Park System of any year since 1933; yet the costs were higher than normal, and the area burned over—24,404 acres—greater. There were 285 fires; 206 of these were man-caused, a marked reduction below the two previous years and especially encouraging, considering that more people visited the parks than ever before.

The costs of fire control have more than doubled during recent years. Salaries and wages, supplies, fire equipment, and transportation all cost more; the 40-hour workweek, with higher pay for overtime, and the necessity of providing relief personnel to man protection positions full time, add greatly to the expense.

The high costs of suppression last year—nearly $200,000 for all areas administered by the National Park Service—and 93 percent of the area burned, are attributable to three large fires. On each of these the lack of adequate communications was largely responsible for the excessive size and cost of control. A lightning fire in Isle Royale National Park and two man-caused fires—one in Yosemite and one in Kings Canyon—all started in remote and rugged terrain, far from any roads. They were detected while still small, but in no case was it possible to get a report into headquarters until many hours had elapsed. Thus the prompt dispatch of fire fighters or reinforcements was disastrously delayed.

There seems to be no doubt that each of those fires could have been held to small size, and low cost, had it been possible to report them promptly. Inability to maintain or replace worn-out or obsolete radio equipment or to keep outpost telephone lines in repair during and since the war resulted in greater direct costs than would have been involved in proper maintenance; to those costs must be added the serious damage to the forests and the disfiguring scars on the park landscape. The need of modernizing the communications systems in the forested parks and of rehabilitation of trails and other protection facilities was stressed in the presentations of the Service's needs to the Bureau of the Budget and the Appropriations Committees.

Forty-eight representatives of the Service's three western regions and one from Region One, embracing the east and south, attended the first interregional fire-control conference, held last April in Grand Canyon National Park. The conference reviewed and analyzed mutual problems of fire control, discussed new methods and techniques, and laid plans for improving and intensifying protection.

Plans for dispatching fire-fighting forces and equipment in forest-fire emergencies have been enlarged and coordinated for all regions on a Service-wide basis. These have been strengthened through the cooperation of the air-rescue service of the United States Air Force in extending assistance on fires.

The extraordinarily severe winter of 1948–49 has created a serious fire hazard in Mount Rainier National Park. Ice and snow frozen to the trees combined with high winds to produce thousands of broken or down trees. Though the work of clearing roads and trails of fallen trees has progressed steadily, the extraordinary amount of debris which must remain untouched will be a cause of concern for some years.

Protection from insect epidemics.—Congress again appropriated funds to continue the program of control of the mountain pine beetle in the lodge-pole pine stands of the Targhee and Teton National Forests, Grand Teton National Park, and Jackson Hole National Monument. However, the appropriation was made so late in the spring of 1949 that it was possible to accomplish only about 44 percent of the work in Grand Teton and Jackson Hole before the beetles emerged from the infested trees. As a result, the program will have to be extended over a longer period.

Observations last spring indicated that the needle-miner population of the white fir in Bryce Canyon National Park had been materially reduced, as a result of the spraying of approximately 1,000 acres with DDT from the air in July 1948. Previously, this infested stand appeared doomed.

An infestation of spruce budworm is building up in the Nyack Valley section of Glacier National Park. A survey of this area by representatives of the Bureau of Entomology and Plant Quarantine is planned for this summer to determine the necessity of treatment to prevent the spread of serious damage.

Blister rust control.—In eight areas of the National Park System a vigorous program of Ribes eradication for the control of white pine blister rust was carried forward. The bulk of the work was in Yosemite, Sequoia, and Kings Canyon National Parks. Initial work was performed on 6,654 acres, with reeradication on 15,161 acres.

In the East the rust was found on white pine in Great Smoky Mountains National Park for the first time last spring, 75 miles south of any previously observed infection on pines. It was found on Ribes in the Smokies for the first time in August 1948.

PROGRESS IN ROUNDING OUT FEDERAL OWNERSHIP

On June 30, 1949, 98 percent of the $200,000 appropriated for the fiscal year 1948 for land acquisition was obligated; of the $200,000 appropriated for 1949, about 70 percent was obligated, and practically all the remainder earmarked for specific purchases. Though these appropriations permit the Service only to nibble at the task of consolidating Federal ownership within the National Park System, more solid progress has been made during the past year than was made in the preceding decade.

One of the most significant acquisitions of the past year was the purchase of Surrender Field, the site on which Cornwallis' troops surrendered to the forces under Washington in 1781, for addition to the Yorktown portion of Colonial National Historical Park.

Forestalling its development for residential purposes, approximately 67 acres of land south of the Eternal-Light Peace Memorial, Gettysburg National Military Park, was purchased. The tract was the scene of an important part of the first day's fighting and of the virtual annihilation of Iverson's Confederate brigade.

In certain situations, progress in land acquisition can be, and frequently has been, accomplished through donation, transfer, and exchange. More than 25,000 acres have been obtained during the year by these methods. More than 20,000 acres of this were acquired for Joshua Tree National Monument. Such exchanges are time-consuming and difficult, but highly important and, where feasible, offer a great opportunity for the reduction of inholdings, particularly in a few western areas. Exchanges now pending involve approximately 50,000 acres.

The bulk of the acquisition problem, both in point of acreage and in point of value of land involved, can be solved only through purchase. Again the Congress is giving consideration to legislation that would recognize the problem as a whole and would authorize substantially larger sums annually over a period of years to be expended on land purchases.

Two large purchases made in Everglades.—Much of the preliminary work of the Everglades land acquisition program is now done, but its ultimate success hinges largely upon the passage of legislation now pending before Congress. This, if enacted, will remove all doubts as to the authority of the Service to acquire privately owned lands by condemnation with the $2,000,000 donated by the State of Florida. Until that authority is assured, progress will continue to be impeded or blocked by landowners unwilling to sell, or willing to dispose of their properties only at excessively high prices.

In acreage acquired through purchase, the year saw great progress. Two purchases from the Model Land Co., aggregating 210,000 acres to which the company had record title, and costing $298,000, were consummated. In order to make these purchases at such a price, however, it was necessary to allow exploration for oil for a period of years, and to permit its recovery, if discovered within that period, until such time as the yield is no longer sufficient to be profitable.

Private lands still unacquired amount to less than half of the lands within the boundaries agreed upon in 1944 which were privately owned when the park was established 2 years ago. They are in many small parcels; the prices which will have to be paid for a number of them will undoubtedly be somewhat higher than those for which the lands already obtained have been purchased.

Leon M. Gray, a distinguished engineer, who, for several years before the war, was the head of Region One's engineering division, and who was placed in charge of the Everglades acquisition program when it was initiated, died in January, after an illness of several months. He was succeeded by Albert B. Manly, who formerly headed the Valuation Section of the Interstate Commerce Commission. Mr. Manly had previously been employed on Mr. Gray's staff as an appraiser.

Independence National Historical Park Project ready for launching.—Public Law 795 of the Eightieth Congress, passed a year ago, authorized the establishment of Independence National Historical Park in Philadelphia and authorized the appropriation of $4,435,000 for the purchase of the required property. An item of $500,000 for this purpose was included in the Interior Appropriation Act passed by the House of Representatives, but not yet acted on by the Senate.

In June Secretary Krug announced the names of the 11 Philadelphians whom he had appointed to serve as members of the Independence National Historical Park Advisory Commission, under authority granted by the 1948 act. These included Judge Edwin O. Lewis, who was chairman of the Philadelphia National Shrines Park Commission; A. G. B. Steel, banker and civic leader; and Arthur C. Kauffman, executive vice president of Gimbel Brothers—all nominated by Gov. James H. Duff of Pennsylvania; three persons nominated by Mayor Bernard R. Samuel of Philadelphia—Thomas Buckley, director of the Department of Public Works; Edward Hopkinson, Jr., chairman of the City Planning Commission; and Albert M. Greenfield, who had served as vice chairman of the Philadelphia National Shrines Park Commission. John P. Hallahan and Sydney E. Martin were recommended by the Carpenters' Co. and the Independence Hall Association, respectively. United States Senator Francis J. Myers, who had also been a member of the other commission; Joseph Silk Clark, Jr., a director of the Citizens' Council on City Planning; and Michael E. Bradley, collector of customs, complete the roster.

The Service will proceed as rapidly as possible with the establishment of the necessary staff for the task ahead.

Proposals for new areas.—Of the 29 areas proposed during the past year for inclusion in the National Park System, only 4 were considered of enough importance to justify even preliminary field investigation.

Two areas suggested because of historic interest were scheduled for investigation, and for consideration by the Advisory Board on National Parks, Historic Sites, Buildings, and Monuments. At the suggestion of the Department, preliminary data were assembled for consideration as to the desirability of national park or monument status for Shishaldin or some other active volcano in the Aleutians.

Progress on authorized projects.—The State of Tennessee has presented for review a deed to approximately 2,200 acres of land to be transferred to the United States for inclusion in the Cumberland Gap

National Historical Park project. A deed to approximately 5,300 acres is virtually ready to be presented by the State of Kentucky. The 1950 fiscal year will probably see Virginia ready to present a deed for its portion, approximately 7,500 acres.

In June just past, a deed for 24 acres of land near Bradenton, Fla., donated as the site of the DeSoto National Memorial, was accepted. At the year's end, establishment of the memorial awaited only the required publication of notice in the Federal Register.

The Castle Clinton National Monument project at the Battery, in New York City, took a step forward when Governor Dewey, on April 28, approved a State act authorizing the city of New York to transfer the property to the United States. The transfer, contingent upon the appropriation of Federal funds for repair and development, must be made before July 1, 1950.

Approximately 54 acres of land, with seven buildings, were acquired from War Assets Administration for the Fort Vancouver National Monument in the State of Washington.

Deficiencies in the title to 1,000 acres to be conveyed by the State of Iowa for the Effigy Mounds National Monument are being cured by the State. It is expected that the monument will be established soon.

The award of $78,895 in a condemnation suit brought by the United States to acquire the 210 acres needed for the George Washington Carver National Monument, near Joplin, Mo., exceeded the amount authorized and appropriated for the purpose by $48,895. Additional authorization and appropriation within the "reasonable time" granted by the court will be required if this project is to be established.

There was a revival of interest in the Cape Hatteras National Seashore Recreational Area project, on which the State of North Carolina had postponed action for several years in order to permit exploration of the area for oil. Representatives of the Service met with a local group at Manteo in June to explain the scope of the project and to dispel certain misunderstandings regarding it which had arisen during the past few years.

St. Croix Monument authorized.—In June, the President approved an act which authorized the establishment of St. Croix Island National Monument, in eastern Maine. The act authorized acceptance of private lands on the island, site of the first French settlement in the New World, and the acquisition of not more than 50 acres on the mainland opposite the island to provide a satisfactory approach to the St. Croix River and an administrative site.

Service activity in disposal of surplus realty.—Public Law 616, approved in June 1948, places on the National Park Service the responsibility of reviewing all applications from States and local governments for the transfer of surplus land holdings for public park, recreational area, and historic monument purposes. During the year, 31 applications, involving as many separate installations, which had cost the Federal Government more than $6,000,000, were referred to the Service for study and recommendation.

Of 24 of these, affecting about 23,500 acres of land and various improvements, and envisioning public park and recreational use, 17 were approved by the War Assets Administration, as recommended by the Service. More than $620,000, representing 50 percent of the fair value, has been paid for them.

Five of the areas were requested solely for historic monument purposes. Fort McDowell (Angel Island) in San Francisco Bay, containing 641 acres, with 235 buildings, and valued at approximately $730,000, is the largest of these. Transfers for historic monument use are made without cost.

The harbor defenses (Fort Moultrie) of Charleston, S. C., turned over to the State Board of Forestry, was one of two areas requested for a combination of park and monument purposes.

The Federal Property and Administrative Service Act of 1949, which established the General Services Administration, provides for the disposal of surplus realty for parks, recreation areas and historic monuments as a permanent function. It is expected that the National Park Service will continue to participate in the surplus property disposal program in cooperation with the General Services Administration.

PERSONNEL SITUATION IMPROVES

The years immediately following the war were marked by many necessary shifts of employees. During the past year, however, there have been no changes in assignments to major administrative or professional positions.

Important from the long-range administrative standpoint was the completion of the conversion of park ranger positions from custodial to administrative grades. The new classification reflects the duties of the positions more accurately, raises the top ranger grade to CAF–11, and recognizes the logical avenue of advancement for park rangers in the career system.

Approximately 100 park rangers have only temporary indefinite appointments. Many of the incumbents of these positions have been on the rolls for more than 3 years; recruitment is difficult for positions offering uncertain tenure. It is a pleasure, therefore, to record that the Civil Service Commission announced a park ranger examination, scheduled for mid-August, offering the definite prospect of establishment of a register from which these positions may be filled on a permanent basis.

In general, hiring experience has improved and the percentage of vacancies in permanent positions is lower than it has been at any time since 1941. However, funds have been insufficient to provide a satisfactory number of professional positions in the entrance, or trainee, grades to insure continuity of staff for the future. Since this situation was acute during the war, there is a gap of nearly 8 years in career progression which is already beginning to handicap the Service in filling positions by promotion from within the organization.

Appropriations for 1949 were sufficient to permit small increases in field staff. Total increases above the wartime staffs have been far less proportionately, however, than the increase in the volume of work which they are called upon to perform.

MISSION TO JAPAN

At the request of the Secretary of the Army, Charles A. Richey, Assistant Chief of Land and Recreational Planning, spent about 3½ months (April 28 to August 11, 1948) in Japan, to undertake a study of the Japanese national park system and the laws which govern it, for the purpose of formulating recommendations for preservation and for organization of the development and administration of the parks "along centralized lines for the public benefit."

During his stay in Japan, working in conjunction with the Civil Information and Education Section, SCAP, Mr. Richey visited 12 of the 13 existing national parks and a number of proposed national park areas. He conferred with all agencies of the occupation forces and of the Japanese central and local governments in any way concerned with the legal, developmental, and administration problems of the park system, and with a large number of civic groups. He reported a tremendous interest among the Japanese people and a great eagerness to learn how to protect their parks and how to manage them most effectively in the interest of the public.

Though admittedly not complete or exhaustive because of the limited time which could be spent in Japan, Mr. Richey's report, submitted to the Civil Information and Education Section, offers a careful analysis of existing conditions and a series of specific recommendations. These covered such matters as the urgent need of assistance to Japan in planning park and recreational facilities, desirable amendments and supplements to existing national park law to provide greater protection, extension of the existing system to include a few more of the outstanding samples of Japanese scenery, the curbing of practices which are destroying some of the natural qualities of the parks, the protection of historic sites, the training of planning personnel, the establishment of both a central administrative organization and a field organization, bureau status for the park administration, parkways, destructive land-use practices, and a variety of other matters.

The National Park Service is gratified that its cooperation was sought in so important an undertaking and proud to have been able to provide the services of so competent a consultant.

LAKE TEXOMA RETURNED TO ENGINEERS

On June 30, 1949, administration of the Lake Texoma Recreational Area, in Texas and Oklahoma, was assumed by the Corps of Engineers of the Department of the Army, which had constructed the Denison Dam on the Red River, thus creating the lake. Termination of the arrangement, under which the National Park Service took over responsibility for the development and management of the lake and the lands surrounding it for recreational use in 1946, was requested by the Department of the Interior. Throughout the period of the Service's responsibility, administration was made difficult by the unsatisfactory division of authority between the Service and the Corps; there was, in addition, considerable local dissatisfaction occasioned by the slow rate of development under Service administration, because of inadequate appropriations, heightened by the belief that the corps would spend much more on developments.

Providing a great variety of water recreation in a part of the country in which opportunities of the sort were previously nonexistent, Lake Texoma quickly attained a volume of public use considerably surpassing that of any other area administered by the Service. From approximately 400,000 visitors during the first year of the Service's administration, the number jumped in 2 years to nearly 2,500,000. During the 9 months of the 1949 travel year that it remained under Service control, the visitor total exceeded 1,900,000.

1949 ERUPTION OF MAUNA LOA

After 6 years and 8 months of quiescence, Mauna Loa, in Hawaii National Park, resumed eruptive activity on January 6. The first phase, January 6–8, consisted of the initial rupture and early fountaining along a 3-mile rift, producing a great flow of pumice-crusted lava. The second, or cone-building phase, lasting nearly a month, included the partial sealing of the rift and the restricting of fountaining to two vents. The larger of the fountains played to heights of 600 to 800 feet, producing an exceptionally large complete cinder and pumice cone. During this phase there were vigorous flows. The third, or lava-cone phase, which began February 6, was still active at the year's end, and may continue for an indefinite time, with the possibility of weak or moderate flows from time to time.

Members of the park staff have thoroughly covered all phases of the eruption, both on the ground and from the air. Excellent color motion pictures were obtained and edited for use in the interpretive program. Research in the study of radiation and heat problems occurring during the various phases of the eruption has been carried on by the park staff and the Geological Survey. Though few park visitors could make the trip to the summit, many of them flew over it at various times. Two flows coursing down the side of the mountain afforded an excellent opportunity to observe that phase of the eruption from a distance.

THE ADVISORY BOARD

The Advisory Board on National Parks, Historic Sites, Buildings, and Monuments, under the chairmanship of Dr. Waldo G. Leland, spent February 8–10 in Washington in a review of National Park Service plans and activities. In addition, the Board determined upon the establishment of six committees—on biological problems, on historical problems, on recreational problems, on educational problems, on liaison, and on review.

Through this group, the National Park Service has available the knowledge and judgment and experience of experts in a number of special fields, furnished freely and with a fine spirit of public service. Their deep interest in national park affairs is combined with an objectivity which those who deal daily with the problems affecting the National Park System can scarcely expect to maintain. Their contributions, as individuals and as a group, are of very great value to the Service.

AIRPORTS AND THE PARKS

The increasingly close relationship between the National Park Service and the Civil Aeronautics Administration is shown by Service cooperation with the Administration in preparing its annually revised national airport plan, looking toward the provision of airports, as the need develops, reasonably close to the entrances of the major national parks and monuments but outside their boundaries. Legislation which would authorize the Department to sponsor or co-sponsor such developments has been introduced in the present Congress.

Membership on the Interior-Commerce Departmental Airport Committee was extended to the Department of Agriculture. The group was redesignated as the Interior-Commerce-Agriculture Airport Committee, on which both the National Park Service and the Forest Service are represented.

The National Park Service has still been unable to reach a solution of the problem of control of flights over the park and monuments, in the interest of safety and of keeping to a minimum the disturbance caused by noise; but the matter is still being studied.

MOUNTAIN CLIMBING IN THE PARKS

Many areas of the National Park System provide a strong lure to the mountain climber, with Rocky Mountain National Park probably the most popular in this respect. For Longs Peak alone, more than 1,800 ascents were recorded. The Teton Mountains, Grand Teton National Park, were the climbing objective of 245 organized parties. A party of 6 attempted to climb Mount McKinley, but only 3 reached the top.

No changes were made in the climbing regulations during the year, since the desires of qualified climbers and mountaineering organizations generally appear to be satisfied under those now in effect. A few experienced climbers continue to advocate the rescinding of all regulations which require climbers to obtain permits from the superintendent or which permit him to prohibit climbs. However, in no case during 1948 was a climb prohibited; on the other hand, several parties, at the time of registration for a climb, altered their plans after listening to the advice of expert climbers on the park staffs.

A number of accidents resulted from failure to observe the regulations and refusal to heed the warnings of Service officers. Temporary lapses from safety precautions were the principal causes of accidents and fatalities. There were five deaths from mountaineering accidents. Three of the victims were visitors, one a Park Service employee off duty, and one a concession employee, also off duty.

To train key men in mountain-rescue work, who could in turn instruct other employees, was the major objective of the first mountain-climbing and rescue training school for Service employees, held at Mount Rainier National Park September 13–17, and attended by representatives of 11 parks and monuments.

NAMES OF GEOGRAPHIC FEATURES APPROVED

The Board on Geographic Names has approved the naming of two peaks in Big Bend National Park in honor of Roger W. Toll and George S. Wright, who were killed in an automobile accident while returning from an official visit to the prospective park in 1936. Also honored by having a peak in Rocky Mountain National Park named for him was Joe Mills, who was active in promoting the establishment of the park. Other decisions of the Board included Oastler Castle, a formation in Bryce Canyon National Park, named for the late Dr.

Frank R. Oastler, one of the originators of the interpretive program of the National Park Service and a member of the advisory Board; Mount Conard and Conard Meadows, Lassen Volcanic National Park, named for Arthur L. Conard, who was active in the establishment and development of that park; Carson Mountain, Shenandoah National Park, named for William E. Carson who, as chairman of the Virginia Conservation and Development Commission, spearheaded the work involved in acquiring lands for Shenandoah; and extensive lists of names of features in Glacier Bay National Monument, Alaska, and the Lake Mead National Recreational Area in Arizona and Nevada.

LIVESTOCK GRAZING

When Jackson Hole National Monument was established in 1943, some of the strongest opposition came from the stockmen who had been using range within the area, and who feared that their grazing privileges would be curtailed or abolished. However, in accordance with the policy immediately announced by Secretary Ickes, established privileges have been determined and recognized, and have been definitely attached to the base lands on which they had been established. All grazing on monument lands is now under term permit and on a routine basis.

The problem of trespass stock continues to be disturbing in a number of areas, particularly where overgrazing results. Its satisfactory solution can be reached only through an extensive fencing program. In some instances the impounding of trespass stock has had a deterrent effect, especially where the trespass has been deliberate.

In several areas the impact of grazing by pack and saddle animals on mountain meadows has become a serious problem. A special study of the problem was made in Yosemite National Park during the past year.

In four areas in the southwest, the year brought a permanent annual reduction of 3,961 animal-use months of livestock grazing.

FIELD NOTES

Service participation in storm relief.—Yellowstone, Rocky Mountain, and Zion National Parks all contributed snow-removal machinery and operating personnel for use in opening snow-blocked roads, under the general direction of the Bureau of Land Management, during the heavy storms of February and March. Glacier and Grand Teton National Parks, Lake Mead Recreational Area, Theodore Roosevelt National Memorial Park, and Arches and Death Valley National Monuments also participated in "Operation Snowbound." Because of distress conditions in the vicinity of Zion, that park made a notable contribution to relieving the situation there before the Bureau took over direction of the work. Also, during late December and early January, roads in northeastern Colorado were blocked so badly that the State highway department was unable to cope with the situation and personnel and equipment from Rocky Mountain National Park were called on for help, which was effectively rendered. High and deserved praise was expressed for the efficiency of the work carried out by National Park Service crews and for their untiring efforts in the emergency.

The unprecedented cold and snow in the higher altitudes of Death Valley National Monument required a long period of snow removal on main roads in that area. Monument personnel made rescues of 12 persons marooned at mines in the mountains and undoubtedly prevented loss of life.

Crater Lake freezes over.—Widespread interest was aroused last February by the fact that Crater Lake, for the first time in recorded history, was solidly frozen over, to depths ranging from 2 to 12 inches, and snow-covered. For more than 2 months, visitors to the park, many of whom were attracted there by this unusual occurrence, beheld an expanse of white in place of the sapphire waters so justly famous.

Service conference at Grand Canyon.—About 150 employees attended the National Park Service conference, held at Grand Canyon October 4–8, 1948. Devoted to intensive and lively discussion of all phases of the Service's work, the meeting was highlighted by Secretary Krug's address and by the ceremony in which the Secretary conferred the Department's distinguished service medal on Assistant Chief Ranger "Bill" Butler of Mount Rainier National Park, for his courageous and successful search for the Marine plane which crashed on the upper South Tahoma Glacier on December 10, 1947.

Two discoveries.—A collection of bones discovered in undisturbed condition under a large accumulation of cave stoneflow in a remote section of Carlsbad Caverns were identified by Dr. J. L. Gazin of the National Museum as those of the ground sloth Notherotherium. Exploration prompted by persistent reports of dinosaur tracks in a wide section of Zion National Park resulted in the finding of 45 to 50 good identifiable tracks on large slabs of rock.

Membership on departmental field committees.—Both the Region Three office in Santa Fe and the Region Four office in San Francisco are represented on Interior Department field committees, to which the regional directors are called upon to devote considerable time. Perhaps the most active of these committees is that for the Pacific Northwest though the work of the Alaska field committee is assuming increasing importance. The comprehensive reports of the Pacific

Northwest committee have required a great deal of research and study by many Service personnel.

Travel volume again sets record.—For the third successive year, travel to the areas administered by the National Park Service set a new record during the travel year ending September 30, 1948. The total was 29,608,318. For the fiscal year 1949, visitors totaled 31,355,951, against 27,881,015 for the 1948 fiscal year.

Yellowstone and Rocky Mountain National Parks each had more than a million visitors for the first time in their history.

Yosemite motion picture.—Last spring the Atwater Kent Foundation gave the original and one copy of the sound-and-color motion picture of Yosemite National Park, taken by Mr. Ted Phillips, to the National Park Service. Arrangement are under way to reproduce and market this film in somewhat shortened and revised form, to bring this fine presentation of a great park to a large audience.

Information relating to the National Park System June 30, 1949

	State	Federal land	Approximate visitors July 1, 1947–June 30, 1948	Approximate visitors July 1, 1948–June 30, 1949
National parks		*Acres*		
Acadia	Maine	28, 309. 68	438, 644	474, 885
Big Bend	Texas	691, 978. 95	35, 098	48, 869
Bryce Canyon	Utah	36, 010. 38	166, 136	179, 406
Carlsbad Caverns	New Mexico	45, 526. 59	422, 226	428, 299
Crater Lake	Oregon	160, 290. 33	359, 314	318, 752
Everglades	Florida	341, 969. 00	(1)	70, 836
Glacier	Montana	997, 695. 04	331, 813	312, 798
Grand Canyon	Arizona	645, 295. 91	620, 875	588, 189
Grand Teton	Wyoming	94, 892. 92	145, 040	154, 521
Great Smoky Mountains	Tennessee-North Carolina	461, 003. 79	1, 277, 846	1, 467, 113
Hawaii	Territory of Hawaii	173, 404. 60	409, 331	393, 580
Hot Springs	Arkansas	1, 019. 13	305, 299	309, 859
Isle Royale	Michigan	133, 838. 51	7, 961	9, 152
Kings Canyon	California	452, 824. 82	239, 262	292, 298
Lassen Volcanic	do	103, 429. 28	147, 458	164, 768
Mammoth Cave	Kentucky	50, 695. 73	190, 059	191, 808
Mesa Verde	Colorado	51, 017. 87	54, 855	62, 787
Mount McKinley	Alaska	1, 939, 319. 04	4, 477	4, 659
Mount Rainier	Washington	241, 524. 77	860, 335	551, 249
Olympic	do	846, 765. 66	188, 183	255, 928
Platt	Oklahoma	911. 97	740, 580	783, 856
Rocky Mountain	Colorado	252, 788. 28	954, 779	1, 014, 134
Sequoia	California	385, 100. 13	354, 481	394, 248
Shenandoah	Virginia	193, 472. 98	887, 646	1, 006, 766
Wind Cave	South Dakota	26, 576. 15	103, 467	112, 793
Yellowstone	Idaho-Montana-Wyoming	2, 213, 206. 55	941, 578	1, 044, 796
Yosemite	California	756, 440. 62	735, 120	773, 177
Zion	Utah	94, 241. 06	285, 728	306, 366
Total		11, 419, 549. 74	11, 207, 591	11, 715, 892
National historical parks				
Abraham Lincoln	Kentucky	116. 50	68, 742	80, 375
Chalmette	Louisiana	33. 25	51, 933	49, 759
Colonial	Virginia	7, 129. 00	691, 744	896, 954
Morristown	New Jersey	958. 37	313, 365	337, 065
Saratoga	New York	2, 087. 59	54, 350	67, 328
Total		10, 324. 71	1, 180, 134	1, 431, 481

See footnotes at end of table.

Information relating to the National Park System June 30, 1949—Continued

	State	Federal land	Approximate visitors July 1, 1947–June 30, 1948	Approximate visitors July 1, 1948–June 30, 1949
National military parks				
		Acres		
Chickamauga and Chattanooga	Georgia-Tennessee	8, 127. 16	271, 526	245, 236
Fort Donelson	Tennessee	102. 54	32, 724	28, 028
Fredericksburg and Spotsylvania.	Virginia	2, 420. 71	107, 043	124, 444
Gettysburg	Pennsylvania	2, 534. 11	657, 050	658, 908
Guilford Courthouse	North Carolina	148. 83	36, 190	35, 970
Kings Mountain	South Carolina	4, 012. 00	32, 813	34, 042
Moores Creek	North Carolina	30. 00	4, 202	5, 811
Petersburg	Virginia	1, 324. 62	138, 383	165, 301
Shiloh	Tennessee	3, 729. 26	275, 276	304, 208
Stones River	do	323. 86	5, 475	5, 550
Vicksburg	Mississippi	1, 323. 56	33, 299	33, 942
Total		24, 076. 65	1, 593, 981	1, 641, 440
National battlefield parks				
Kennesaw Mountain	Georgia	3, 094. 21	41, 362	45, 983
Richmond	Virginia	684. 44	26, 100	38, 154
Total		3, 778. 65	67, 462	84, 137
National memorial parks				
Theodore Roosevelt	North Dakota	58, 341. 26	[2] 4, 563	63, 470
National monuments				
Ackia Battleground	Mississippi	49. 15	(1)	(1)
Andrew Johnson	Tennessee	17. 08	24, 496	22, 194
Appomattox Court House	Virginia	968. 25	25, 600	29, 350
Arches	Utah	33, 929. 94	6, 807	11, 335
Aztec Ruins	New Mexico	27. 14	13, 886	14, 932
Badlands	South Dakota	122, 972. 46	345, 712	392, 476
Bandelier	New Mexico	27, 048. 89	26, 710	30, 414
Big Hole Battlefield	Montana	200. 00	2, 585	3, 133
Black Canyon of the Gunnison	Colorado	13, 176. 02	23, 710	25, 167
Cabrillo	California	0. 50	382, 447	444, 637
Canyon de Chelly	Arizona	83, 840. 00	2, 021	2, 460
Capitol Reef	Utah	33, 068. 74	(1)	(1)
Capulin Mountain	New Mexico	680. 42	30, 600	32, 100
Casa Grande	Arizona	472. 50	36, 837	30, 752
Castillo de San Marcos	Florida	18. 51	266, 169	312, 880
Castle Pinckney	South Carolina	3. 50	(1)	(1)
Cedar Breaks	Utah	6, 172. 20	29, 228	34, 948
Chaco Canyon	New Mexico	18, 039. 39	1, 107	1, 303
Channel Islands	California	[3] 26, 819. 26	(1)	(1)
Chiricahua	Arizona	10, 529. 80	13, 916	15, 274
Colorado	Colorado	18, 120. 55	58, 596	65, 959
Craters of the Moon	Idaho	47, 210. 67	28, 007	33, 452
Custer Battlefield	Montana	765. 34	60, 237	74, 264
Death Valley	California-Nevada	1, 850, 565. 20	161, 359	156, 153
Devil Postpile	California	798. 46	(1)	(1)
Devils Tower	Wyoming	1, 193. 91	41, 214	53, 391
Dinosaur	Colorado-Utah	190, 798. 49	10, 222	11, 783
El Morro	New Mexico	240. 00	1, 672	2, 690
Father Millet Cross	New York	. 01	(1)	(1)
Fort Frederica	Georgia	74. 53	47, 722	54, 759
Fort Jefferson	Florida	[4] 47, 125. 00	7, 053	7, 111
Fort Laramie	Wyoming	214. 41	12, 159	15, 295
Fort Matanzas	Florida	227. 76	13, 211	15, 665
Fort McHenry	Maryland	47. 64	458, 416	527, 147
Fort Pulaski	Georgia	5, 427. 39	35, 074	37, 459
Fort Sumter	South Carolina	2. 40	(1)	(1)
Fossil Cycad	South Dakota	320. 00	(1)	(1)
George Washington Birthplace	Virginia	393. 68	40, 000	43, 882
Gila Cliff Dwellings	New Mexico	160. 00	(1)	(1)
Glacier Bay	Alaska	2, 297, 597. 73	(1)	(1)
Grand Canyon	Arizona	196, 051. 00	137	168
Gran Quivira	New Mexico	450. 94	2, 266	2, 501
Great Sand Dunes	Colorado	35, 908. 19	15, 989	18, 665
Holy Cross	do	1, 392. 00	(1)	(1)
Homestead	Nebraska	162. 73	2, 731	2, 411

See footnotes at end of table.

Information relating to the National Park System June 30, 1949—Continued

	State	Federal land	Approximate visitors July 1, 1947–June 30, 1948	Approximate visitors July 1, 1948–June 30, 1949
National monuments—Con.				
		Acres		
Hovenweep	Utah-Colorado	299. 34	156	198
Jackson Hole	Wyoming	173, 064. 62	(1)	(1)
Jewel Cave	South Dakota	1, 274. 56	15, 276	8, 675
Joshua Tree	California	687, 031. 60	60, 671	63, 580
Katmai	Alaska	2, 697, 590. 00	(1)	(1)
Lava Beds	California	46, 027. 56	33, 768	35, 506
Lehman Caves	Nevada	640. 00	5, 297	6, 447
Meriwether Lewis	Tennessee	300. 00	13, 229	15, 411
Montezuma Castle	Arizona	783. 09	25, 495	28, 181
Mound City Group	Ohio	57. 00	34, 299	39, 862
Muir Woods	California	424. 56	282, 469	269, 793
Natural Bridges	Utah	2, 649. 70	1, 190	1, 154
Navajo	Arizona	360. 00	405	661
Ocmulgee	Georgia	683. 48	27, 469	31, 624
Old Kasaan	Alaska	38. 00	(1)	(1)
Oregon Caves	Oregon	480. 00	80, 938	74, 054
Organ Pipe Cactus	Arizona	328, 161. 73	94, 449	121, 615
Perry's Victory	Ohio	14. 25	41, 253	85, 606
Petrified Forest	Arizona	85, 303. 63	340, 098	332, 033
Pinnacles	California	12, 817. 77	19, 638	21, 772
Pipe Spring	Arizona	40. 00	743	1, 057
Pipestone	Minnesota	115. 60	5, 143	21, 435
Rainbow Bridge	Utah	160. 00	(1)	(1)
Saguaro	Arizona	53, 669. 24	19, 867	21, 592
Scotts Bluff	Nebraska	2, 196. 44	45, 884	52, 050
Shoshone Cavern	Wyoming	212. 37	(5)	(5)
Sitka	Alaska	57. 00	6, 735	6, 584
Statute of Liberty	New York	10. 38	537, 171	555, 961
Sunset Crater	Arizona	3, 040. 00	20, 699	26, 371
Timpanogos Cave	Utah	250. 00	54, 492	59, 598
Tonto	Arizona	1, 120. 00	15, 761	16, 517
Tumacacori	do	10. 00	26, 425	24, 904
Tuzigoot	do	42. 67	16, 900	17, 010
Verendrye	North Dakota	253. 04	(1)	(1)
Walnut Canyon	Arizona	1, 641. 62	20, 613	21, 296
Wheeler	Colorado	300. 00	(1)	(1)
White Sands	New Mexico	140, 247. 04	106, 134	138, 653
Whitman	Washington	45. 84	(1)	17, 262
Wupatki	Arizona	34, 853. 03	4, 999	5, 710
Yucca House	Colorado	9. 60	93	32
Zion	Utah	33, 920. 75	(1)	(1)
Total		9, 383, 477. 29	4, 185, 655	4, 638, 314
National battlefield sites				
Antietam	Maryland	183. 33	32, 205	32, 653
Brices Crossroads	Mississippi	1. 00	(1)	(1)
Cowpens	South Carolina	1. 00	1, 419	1, 910
Fort Necessity	Pennsylvania	2. 00	80, 096	89, 399
Tupelo	Mississippi	1. 00	(1)	(1)
White Plains	New York	00	(1)	(1)
Total		188. 33	113, 720	123, 962
National historic sites				
Adams Mansion	Massachusetts	4. 05	1, 614	6, 739
Atlanta Campaign Markers	Georgia	20. 96	(1)	(1)
Federal Hall Memorial	New York	0. 49	76, 656	77, 381
Fort Raleigh	North Carolina	16. 45	103, 846	105, 407
Hampton	Maryland	43. 30	(1)	(1)
Home of Franklin D. Roosevelt	New York	33. 23	473, 724	454, 564
Hopewell Village	Pennsylvania	848. 06	73, 249	81, 373
Jefferson National Expansion Memorial.	Missouri	82. 58	28, 055	24, 555
Manassas Battlefield Park	Virginia	1, 604. 57	9, 332	19, 838
Old Philadelphia Custom House	Pennsylvania	0. 79	26, 100	26, 165
Salem Maritime	Massachusetts	8. 61	15, 916	21, 184
Vanderbilt Mansion	New York	211. 65	61, 256	73, 022
Total		2, 874. 74	869, 748	890, 228
San Juan	Puerto Rico	[6] 40. 00		(1)

See footnotes at end of table.

Information relating to the National Park System June 30, 1949—Continued

	State	Federal land	Approximate visitors July 1, 1947–June 30, 1948	Approximate visitors July 1, 1948–June 30, 1949
National memorials				
		Acres		
House Where Lincoln Died	District of Columbia	0.05	55, 153	53, 254
Kill Devil Hill	North Carolina	314. 40	80, 784	75, 663
Lee Mansion	Virginia	2. 71	311, 573	330, 745
Lincoln Memorial	District of Columbia	.61	1, 511, 390	1, 605, 645
Lincoln Museum	do	.18	102, 100	105, 267
Mount Rushmore	South Dakota	1, 668. 27	445, 174	628, 845
New Echota Marker	Georgia	.92	(1)	(1)
Thomas Jefferson	District of Columbia	1. 20	560, 896	544, 081
Washington Monument	do	.37	799, 548	851, 272
Total		1, 988. 71	3, 866, 618	4, 194, 772
National cemeteries				
Antietam	Maryland	11. 36	(7)	(7)
Battleground	District of Columbia	1. 03	2, 700	2, 700
Fort Donelson	Tennessee	15. 34	(7)	(7)
Fredericksburg	Virginia	12. 00	(7)	(7)
Gettysburg	Pennsylvania	15. 55	(7)	(7)
Poplar Grove	Virginia	8. 72	(7)	(7)
Shiloh	Tennessee	10. 25	(7)	(7)
Stones River	do	20. 09	(7)	(7)
Vicksburg	Mississippi	119. 76	(7)	(7)
Yorktown	Virginia	2. 91	(7)	(7)
Total		217. 01	2, 700	2, 700
National parkways				
Blue Ridge	North Carolina-Virginia	44, 822. 61	1, 371, 481	1, 507, 036
George Washington Memorial	Virginia-Maryland	2, 912. 67	(1)	(1)
Natchez Trace	Tennessee-Alabama-Mississippi.	13, 648. 87	(1)	(1)
Total		61, 384. 15	1, 371, 481	1, 507, 036
National capital parks				
National Capital Parks	Maryland-Virginia-District of Columbia.	29, 046. 52	(8)	(8)
Grand total National Park System.		20, 995, 247. 76	24, 463, 653	26, 293, 432

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[1] No travel figures available or maintained.

[2] Travel shown from May through June 1948 only.

[3] Area encompassed by map included with and made a part of Presidential proclamation extending monument boundaries is approximately 26,819.26 acres.

[4] Area encompassed on map included with and made a part of Presidential proclamation establishing monument. Land area only is 86.82 acres.

[5] Closed to public.

[6] Acreage approximate only. Area not included in historic site figures nor National Park System total acreage since it is administered by agreement with the Department of the Army, which has basic jurisdiction.

[7] Included in travel figures of adjacent battlefield sites, military or historical parks, or memorials.

[8] Travel reported only for national memorials under National Capital Parks administration; shown under national memorials.

Information relating to projects and areas under the jurisdiction of the National Park Service but not within the National Park System, June 30, 1949

	State	Federal land acres	Approximate visitors July 1, 1947–June 30, 1948	Approximate visitors July 1 1948–June 30, 1949
National recreational areas				
Coulee Dam	Washington	98, 500. 00	106, 270	269, 217
Lake Mead	Arizona-Nevada	1, 899, 728. 00	1, 576, 689	1, 507, 800
Millerton Lake	California	11, 605. 00	352, 280	389, 241
Lake Texoma	Texas-Oklahoma		1, 382, 123	2, 996, 261
Total		2, 009, 833. 00	3, 417, 362	5, 162, 519
Recreational demonstration areas				
Catoctin	Maryland	9, 918. 28	(1)	(1)
Custer	South Dakota	6, 083. 00	(1)	(1)
Total		16, 001. 28		
National historic sites not federally owned				
Gloria Dei	Pennsylvania	1. 20		(1)
Independence Hall	do			
Jamestown	Virginia			
McLoughlin House	Oregon			
Saint Paul's Church	New York			
San Jose Mission	Texas			
Touro Synagogue	Rhode Island			
Total		1. 20		
Projects [2]				
Independence National Historical Park	Pennsylvania	. 63		
DeSoto National Memorial	Florida	24. 18		
Cape Hatteras National Seashore Recreational Area.	North Carolina	82. 10		
Olympic Ocean Strip and Queets Corridor.	Washington	44, 963. 00		
Total		45, 069. 91		
Grand total, National Park System; other areas under jurisdiction of National Park Service; San Juan National Historic Site, under basic jurisdiction of the Department of the Army; and projects.		23, 066, 193. 15	27, 881, 015	31, 455, 951

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[1] No travel figures available or maintained.

[2] Includes only those in which lands are under National Park Service administration.

Bureau of Indian Affairs

John R. Nichols, *Commissioner*

AS WAS reported last year, a beginning was made during fiscal year 1948 to profit from the accumulation of basic resource data brought together by Indian Service technicians. (See the Annual Report of the Secretary of the Interior, 1948, for an account of area program field surveys carried out by the Bureau of Indian Affairs since 1934.) This beginning took the form of a long-range program of rehabilitation and resource development for the Navajo-Hopi Reservation areas in New Mexico, Arizona, and Utah. Much of the material presented to the Congress in support of this program was the product of extensive studies over a period of 14 years of range resources, conservation methods, livestock breeding, water table levels, population characteristics, and similar physical and human factors.

The second major area program and supporting report was completed in fiscal year 1949—dealing with the 7,000 Papago Indians of southern Arizona. This tribe, like the Navajo and Hopi Indians, is one of the least favored, in terms of resources and economic opportunity, of any in the United States. While the Papago Tribal Council assumed a major responsibility for the preparation of this program, the council members found at hand an abundance of data in their reservation headquarters.

Several Indian tribes, upon learning of the action being taken in behalf of the Navajo, Hopi, and Papago Tribes, urged upon the Congressmen and Senators of their respective States that legislation authorizing basic rehabilitation programs be immediately introduced for their benefit. Accordingly, bills calling for capital expenditures, loan funds, and like items were introduced in behalf of the following tribes in the amounts stated:

Standing Rock Sioux, $10,000,000.
Sisseton-Wahpeton Sioux, $1,000,000.
Fort Belknap Indian Community, $5,500,000.
Chippewa Cree Indians of the Rocky Boys Reservation, $3,510,000.
Devils Lake Sioux, $2,000,000.
Blackfeet Tribe of the Blackfeet Reservation, $2,000,000.

These bills were not supported by the kind of documentation which accompanied the Navajo-Hopi and the Papago programs. On the other hand, the Indians of these reservations and the interested Members of Congress had the advantage of the findings and reports of previous surveys.

THE ROLE OF GOVERNMENT

It is not the intention of the Federal Government to continue in the role of trustee of the Indians' property. The role was not assumed arbitrarily but devolved upon the United States out of historic antecedents. Colonial law generally guaranteed the Indians protection in their land holdings. The Royal Proclamation of October 7, 1763, was a declaration by the King of England that the several nations or tribes of Indians "who live under our protection, should not be molested or disturbed in the possession of such parts of our dominion and territories as, not having been ceded to, or purchased by us, are reserved to them." The United States incorporated similar policy into its basic law, declaring in the Northwest Ordinance of 1787:

> The utmost good faith shall always be observed towards the Indians; their land and property shall never be taken from them without their consent.

The protective role was dictated as a matter of public policy; moreover, it was most often the direct result of a treaty provision between an Indian tribe and the United States, in which the tribe requested protection for its members and its property. It is realized, however, that protective guardianship, if pursued without regard to the welfare of the person protected, can defeat its purpose. Development of the property to full utilization and encouragement of the owner to accept responsibility for management—these are the proper goals of Indian administration. They are the means by which the United States may, within a reasonable time, withdraw entirely from its historic role and turn over its trusteeship to a trained and responsible Indian people.

The procedure by which the United States may bring about a transfer of responsibility and authority to organized Indian communities has been in operation for some years.

In accordance with this procedure, during the fiscal year 1949, the Secretary of the Interior issued an order to relinquish departmental supervision over certain tribal affairs of the Saginaw Chippewa Indians. These Indians, numbering 540, live in Isabella County in lower Michigan; about 64 percent of this tribe is less than full-blood Indian, with only the older members still speaking their native Chippewa. The resources remaining to the Saginaw Tribe consist of about 1,800 acres of individually owned farm land, most of it of poor quality, and 450 acres purchased for the tribe in recent years. The tribe adopted a written constitution on May 8, 1937, in accordance with the Indian Reorganization Act of June 18, 1934, and on August

28 of the same year a charter of incorporation was issued by the Secretary of the Interior and ratified by tribal vote.

The tribal charter provided that transactions involving land leases or timber sales, certificates of interest in corporate property, the borrowing of money, the making of contracts calling for money payments, and other actions required approval of the Secretary of the Interior during an interim period of 5 years. Thereafter, the tribe could request the Secretary to relinquish his control over any or all of the actions, the Secretary having authority to grant the request or require the tribe to vote on the question.

Such a request was made in the form of a resolution adopted by the Saginaw Tribal Council. The Secretary, after carefully studying the progress made by the tribe since 1937, notified the council on July 18, 1949, that he saw "no reason why this Department should continue to exercise supervision" over the tribe with respect to the items in question.

Similar action in regard to the Stockbridge-Munsee Indians of Wisconsin, numbering about 500, was taken in 1948. As in the case of the Saginaw Chippewa Indians, the Wisconsin Indians are predominantly mixed blood and are well assimilated in the surrounding economic and social pattern.

LEGAL BASIS OF PRESENT POLICY

The legislative authority for the action taken in the case of these two tribes is the Indian Reorganization Act (Wheeler-Howard Act of 1934). This act protects the remaining Indian trust and tribal land against continued loss; it provides for increasing the Indian land holdings; it authorizes modern forms of organization to enable the Indians to make better use of their resources and it establishes a revolving fund of $10,000,000 for financing credit to Indians.

The central point of the Indian Reorganization Act may be found in the provisions dealing with tribal government and incorporation. The act recognized that native forms had not expired and recognized, as well, John Marshall's legal thesis that a weaker people lost none of its attributes of power by the simple act of coming under the protection of a stronger. Thus, it was an invitation to the various tribes to assert their right to run their own affairs, to set up the machinery necessary for effective self-government under modern conditions. Inherent in the act is the promise that, once tribal self-government is established no executive official can abolish it or transfer its legitimate functions, but it can be altered or changed only by the tribe itself or by Congress. This self-government included, of course, the authority to the tribes to organize for business purposes, to buy land, receive credit funds, sue, and be sued. On the other hand, the property of the tribal corporation is protected against taxation, attachment, and so forth. Also, they cannot sell or mortgage any of the land within the reservation, except upon permission of the Secretary of the Interior.

MAGNITUDE OF THE PROBLEM

Since Congress in 1819 first appropriated funds "for introducing among (the Indians) the habits and arts of civilization," it has been the policy of the United States Government to educate the Indian people, to direct them into pursuits by which they might gain a livelihood, and to seek to incorporate them into the general population.

While this has been the basic and continuing objective of our Nation, the means of successfully accomplishing it has never been placed in the hands of the responsible administrative branch. It is to be doubted that the executive has even presented to the legislative branch a complete estimate of what the "cost" of "civilizing" the Indians might entail. Through the years it was assumed in the executive branch and in Congress that the annual requests for funds and for authorities to act in Indian affairs were in fact annual installments and steps leading toward the final liquidation of the problem.

Problems of human adjustment do not solve themselves, not when the people seeking to make the adjustment are hampered by lack of education, poor health, and deficient resources. The expenditures which have been made over the years in behalf of our Indian people were not based on any long-term plan for the orderly solving of the problems they faced. Rather, the record indicates that these expenditures and the physical effort released by them have been sporadic, discontinuous and generally insufficient.

This record explains why today many Indian children of school age have no schoolrooms and no teachers to provide for their education; why many Indians are still without any kind of health care; why thousands of Indians are without any means of livelihood, either in the form of productive resources or marketable skills; why irrigable lands owned by Indians lie undeveloped in the arid West; why countless Indian communities are without roads on which to travel to school, to hospital, or to market.

Congress became aware of the deficiencies which beset the Navajo and Hopi Indians and, in Public Law 390 (80th Cong., 1st sess.), approved December 19, 1947, directed the Secretary of the Interior "to submit to the Congress his recommendation for necessary legislation for a long-range program" dealing with these Indians. The

Secretary later presented such a program, and supporting legislation, necessitating an expenditure of $90,000,000 over a 10-year period.

The time should be close when the whole Indian problem should be brought under scrutiny and solutions mapped out. The 400,000 Indians in the United States with their 56,000,000 acres of undeveloped lands represent human and natural resources which our Nation cannot afford to neglect. The average income of Indian farm families in recent years has amounted to about $500 at a time when the national farm income average was about $2,500. So long as our Indian people remain inadequately educated and in poor health, and so long as their resources remain only partly utilized, they will constitute a burden upon the public treasury and they, as individuals, will look upon the United States as unfaithful guardians of a trust. At a time when we are sharing our resources with other peoples throughout the world we should deal no less generously with the Indian citizens of our own country who have endured so much for so long.

Basically, the Indian "problem" is one that calls for men, money, and imaginative and patient management. There are no panaceas, no "overnight" solutions. But it is along some such lines that we must move to discharge our ancient obligation to the American Indian. As the Hoover Committee on Indian Affairs reported:

> An ultimate substantial reduction in Federal expenditures in the field of Indian affairs is possible * * *. No immediate reduction can be made without delaying progress and postponing the time when expenditures can be curtailed substantially. * * * The length of time before expenditures can be reduced, without building up future costs, will depend largely upon the vigor with which the program is pushed. Vigor will depend on clear and consistent policy, leadership, and financial support.

LAND LOSSES

Again it must be reported that the rising demand for land and the high prices being paid have resulted in many Indians requesting sale or removal of restrictions from their lands. During the past fiscal year 871 patents in fee, covering 146,655 acres of land, were issued to Indian owners. This is more than twice the number of fee patents issued during the fiscal year 1948. In addition to the land alienated by the issuance of patents in fee, approximately 10,000 acres were alienated through the approval of deeds and issuance of certificates of competency and orders removing restrictions by the Secretary of the Interior. The latter total is exclusive of actions taken in the Five Civilized Tribes area of Oklahoma where approximately 900 tracts, embracing about 75,000 acres of land, were removed in accordance with special laws operating in that area.

The rate at which patents are being issued is evidently accelerating. Thus, in the first 6 months of 1949, patents covering 102,495 acres were allowed while during the entire year of 1948 a total area of 84,860 acres was involved.

It is disturbing to report for a second year that the demand for fee patents and for the removal of restrictions against alienation has taken a sharp upward turn. The disastrous results of the forced patenting of the 1920's are well known. The Meriam Report of 1928 warned of the relatively small number of Indians who had been declared competent to manage their own affairs and who had retained possession of their property. With the ending of the sale of Indian allotments and heirship lands, except in case of emergency, in 1933 by the Secretary of the Interior, the situation was somewhat eased. Later, the Indian Reorganization Act declared that no land remaining in tribal ownership should be individually allotted, but the prohibition applied only to those tribes that voted to accept the application of the act.

The importance of land as a resource base for Indians was emphasized in the report of the Hoover Committee on Indian Affairs, which declared that "further alienation of Indian-owned resources should be stopped." The report went on to state that issuance of fee patents and removal of restrictions on land should be discontinued until it is clear that such action is not in conflict with the area programs, such as the Navajo and the Papago. The report further declared:

> Holding resources in Indian ownership will reduce the expense to the public as well as improve the ultimate position of Indian people. * * * The profit to the Indian is twofold: He increases his income and he acquires that experience as a farmer or rancher, or businessman that is indispensable to true "competence." * * * Successful experience of this sort is also of enormous benefit in maturing Indians in the values of modern economic life. * * * The practice of allotting land and issuing fee patents obviously did not make Indians "competent." It proved to be chiefly a way of getting Indian land into non-Indian ownership.

Loss of Indian-owned trust or restricted land through sales, issuance of fee patents, and orders removing restrictions or granting certificates of competency was partly offset by acquisition of lands and the consolidation of Indian-owned lands into economic units. During 1948 emphasis was again placed upon the acquisition by various tribes of the complex heirship lands in predominantly Indian-owned areas and the consolidation of scattered tracts through the process of exchange. During the past year approximately 2,500 instruments of land conveyance were approved in connection with the land acquisition program.

Since the limited funds available for the purchase of lands and the authority to purchase, sell, and exchange Indian-owned lands were not adequate to afford a land consolidation program on a sufficiently wide scale to correct the "checkerboard" land pattern, legislation was proposed (H. R. 5099, 81st Cong.) to authorize an appropriation of $25,000,000 to enable the Secretary of the Interior to acquire land for resale to Indians on a long-term payment basis. Proceeds derived from such transactions would reimburse the United States in full for the funds advanced.

Other legislation proposed during the year would correct inequities in the land-use pattern and improve the economic base of the Indian. One proposal would authorize the leasing of Indian-owned lands for a period of time long enough to permit lessees to improve the land itself or to make improvements upon it for public, religious, educational, recreational, or business purposes. Likewise, it would permit the lessees to subjugate and place improvements on agricultural land which later would make it possible for the Indians to use the land. Such legislation would allow maximum use of Indian-owned lands for specific purposes, as is now the case in the State of Washington under terms of the act of August 9, 1946 (60 Stat. 962), which authorizes the leasing of Indian lands for periods up to 25 years. Legislation has also been prepared to facilitate transfer of the management over Indian lands in California to individual Indians and groups of Indians who demonstrate ability to assume the responsibilities of land ownership. This legislation would also authorize execution of 25-year leases on trust or restricted lands.

The Bureau cooperated with the Colville (Wash.) tribe in preparing legislation (S. 1022 and H. R. 2432) which would restore approximately 818,000 acres of land, comprising the undisposed portion of the "opened" lands of the diminished Colville Indian Reservation that was authorized to be classified and opened to public disposition by the act of March 22, 1906 (34 Stat. 80). Approximately 475,000 acres of this land are valued for timber purposes. Restoration of these lands would provide a secure economic base for the Colville Indians.

The act of August 13, 1949 (Public Law 226, 81st Cong., 1st sess.), declared that the United States now holds title to 609,713 acres of land in trust for the Pueblo Indians and the Canoncito Navajo group in New Mexico. This legislation confirmed in the Indians the continuing right to occupy and use the lands which they have improved during the past several years with their own money and labor.

During 1948 the Secretary of the Interior approved the allotment selections of 27 members of the Agua Caliente band of Mission Indians, Palm Springs, Calif. Other members of the band have made selections which are now before the Department for consideration.

MINERALS DEVELOPMENT

The coordinated efforts of the Indians, the Federal Government and industry have resulted in maintaining the accelerated development of Indian mineral resources. There is close cooperation with the State and Federal Government agencies and the oil and gas industries in initiating and administering unit plans of operation, well spacing orders and repressuring operations. Exploratory operations are being vigorously pursued under permits and leases on a basis of sound conservation principles.

There is under consideration a water-flood repressuring project for the North Burbank field in the Osage Reservation, Okla. The reduced production from the field makes it necessary that the repressuring be on terms that will be beneficial to the Indians and enable the industry to develop the field on a sound economic basis. The field covers approximately 18,000 acres. If the negotiations are completed, it will be one of the largest water-flood repressuring projects of its kind.

Since the completion of the Hulah Dam in Oklahoma by the Army, it will be necessary for the Osage tribe to convey a part of its producing oil and gas land to the United States. Negotiations are under way for settlement of damages for the taking of the land.

As the result of oil and gas exploratory operations on the Uintah and Ouray Reservation, Utah, a strong interest has developed, and it is anticipated that considerable revenue will accrue to the Indians in bonuses, rents, and royalties.

The purchase of the Choctaw and Chickasaw segregated coal and asphalt lands by the United States was consummated by the appropriation of the purchase price of $8,500,000 in the Deficiency Appropriation Act of May 24, 1949. The lands comprise 370,000 acres of coal deposits, 2,800 acres of asphalt deposits, and 11,000 acres of surface lands. Distribution of the purchase price per capita will terminate a trusteeship of many years.

The following figures show the extent of Indian land mineral leasing and producing activities:

Acreage under oil and gas leases acres	1, 136, 363
Number of oil and gas leases in force	8, 095
Oil and gas wells	11, 213
Acreage under lease for minerals other than oil and gas acres	14, 541
Leases sold during fiscal year	1, 156
Bonus received	$2, 111, 905
Income to individual Indians from mineral leasing and production	$11, 742, 174

RESOURCE FINANCING

Every study of Indian affairs that has been made since the turn of the century has emphasized the need of an adequate source of credit and technical advice on the best methods of using credit. Lack of an adequate credit source was one of the principal reasons for the poverty of the Indians noted in the Meriam Survey. Likewise, the report of the Hoover Committee on Indian Affairs stressed the need for credit.

Under the authorization contained in the Indian Reorganization Act of 1934, Congress appropriated $5,500,000 for loans. To this credit pool the Indians added $1,800,000 of their own funds. At the close of the fiscal year on June 30, 1949, loans totaling more than $20,933,495 had been made, including Federal and tribal money. Most of these loans are made by the United States to the tribal corporations, credit associations, and cooperative groups. These bodies, in turn, lend to individuals or tribal enterprises. Loans are made for purposes that will improve the economic condition of the Indians. The repayment record thus becomes a fairly good device for measuring the progress made in improving the lot of the Indians.

The repayment record is especially good. On loans totaling $13,175,111.61, the sum of $7,790,836.65 was due on June 30, 1949. Of this amount $7,564,267.29 was repaid. Repayments totaling $6,502.01 were in transit, $146,287.78 was extended, and $3,626.95 canceled. Only $70,152.62 was delinquent and a considerable portion of that amount is collectible.

Loans are now being made in 22 States and Alaska. The types of enterprises financed vary. Three salmon canneries have been purchased and financed in Alaska and are operating successfully. Loans have been made to many Eskimo villages for the operation of native stores around which the entire economy of the villages center. Throughout the reservations of the Great Plains area most of the loans are made for agricultural enterprises, principally livestock. Livestock enterprises also are financed in the Southwest area. In the Northwest and the Lake States areas, loans are granted mainly for fishing and allied enterprises.

Experience with loans from the Revolving Credit Fund, supplemented with tribal funds, shows that Indians are good credit risks. In order to succeed with their credit financed enterprises, however, they require assistance such as that supplied by extension workers.

Begun during 1930, the extension program now provides workers for 45 of the 55 Indian agencies, with the goal of helping the Indians to help themselves. Indians are now organized into livestock associations and 4–H Clubs for Indian youth. Through these organizations Indians participate in the planning of economic programs and are thus encouraged to develop leadership and initiative.

Evidence of the progress made in the extension program may be noted in the beef cattle program. In 1932 the Indians owned approximately 170,800 head of beef cattle. At the close of 1948 they owned over 363,000 head valued at $45,000,000. Income for sales of live and dressed cattle during 1948 totaled $17,859,000. Here may be mentioned the successful beef cattle enterprise on the San Carlos Reservation in Arizona, where, in 1948, the Indians received an income of $1,463,000 from their beef cattle program. The quality of their cattle has been improved to the point where they are known throughout the cattle industry. During the past 9 years 110,600 head of Apache-owned cattle were sold at auction sales and have gone into the States of Arizona, California, Texas, Oklahoma, Kansas, Nebraska, South Dakota, and New Mexico.

Another successful beef cattle enterprise is to be found at the Carson Agency, Stewart, Nev. Indian cattlemen there received an income of $431,600 in 1948 from beef cattle, receiving generally from $1 to $1.50 more per hundredweight than their white neighbors for the better quality of cattle produced.

Turkey raising has become an important industry at several Nevada reservations. During the 1948 season growers at Campbell Ranch marketed 2,295 birds for gross sales of $24,000. On the Fallon Reservation, 2,700 turkeys were sold for $28,000, of which $11,000 is considered profit. The Walker River Indians have also taken to raising turkeys and sold 1,700 birds for over $16,000.

On the Navajo Reservation, where emphasis has been placed on improving the quality of the stock, the average weight per fleece has increased from 4 to 6 pounds. Based on the number of mature ewes the percent of lamb crop has increased from 61 to 85 percent. The total weight of all wool has increased from 1,485,000 pounds (1930) to over 2,300,000 pounds (1948). These improvements are the result of the research work of the sheep breeding laboratory established and operated cooperatively by the Bureau of Animal Industry of the Department of Agriculture and the Bureau of Indian Affairs, and of the general livestock improvement program conducted on the reservation.

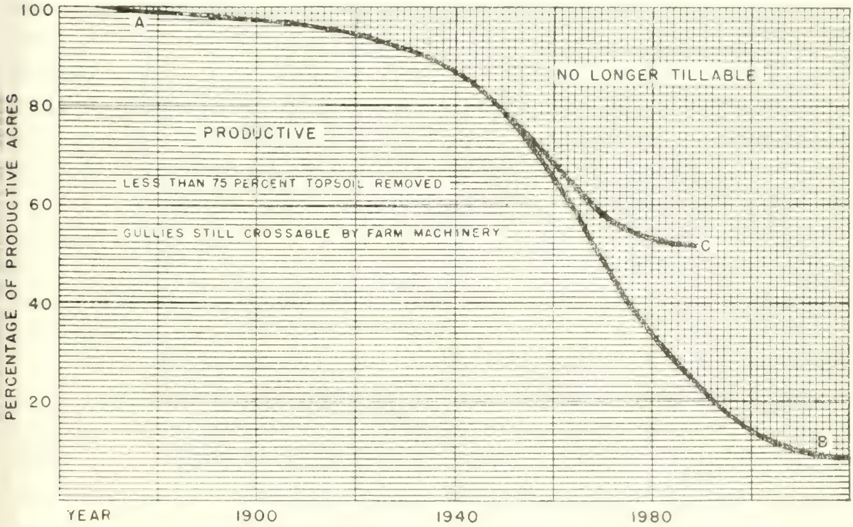
In 1934, some 29,000 Indian families were engaged in farming, compared with 40,200 families in 1948. The acreage farmed increased from 514,000 acres in 1934 to 854,000 acres in 1948. In the same period beef and dairy cattle numbers increased from 254,700 to 411,000.

RESOURCE CONSERVATION

The ultimate position of the Indian people is primarily dependent on full use of their soil and water resources on a sustained yield basis. Alienation of Indian lands has materially reduced their opportunity to become competent and independent. Equally deplorable has been the loss of productivity through land depletion and erosion brought about by misuse.

Loss of production has been common under all types of land use. It has been most severe, however, on farm land under cultivation. A total of 700,000 acres, or more than 20 percent of productive Indian farm land has been rendered unfit for cultivation by excessive gullying and removal of topsoil.

LOSS OF PRODUCTIVE INDIAN FARM LAND CAUSED BY EROSION



The present rate of erosion loss of Indian lands is about 36,000 acres a year. Curve A–B in the graph above shows the loss to date and the rate at which it would continue without application of soil conservation practices. Curve A–C shows reduction of loss and saving of land under the program of soil conservation since its beginning on farm lands in 1941. End of the line at C shows how long it will take (42 years) to complete soil conservation at the present rate. Doubling the program and completing the work in half the time will prevent the loss of approximately 400,000 acres.

There has been more advance in the application of soil improvement practices on Indian lands in the past 5 years than in the preceding 25 years. During 1948, for the first time since breaking up the virgin soil, a total of 367,182 acres was planted to leguminous green manure crops, 61,000 acres limed, and 167,500 acres treated with commercial fertilizer. Land leveling, terracing, rough tillage, and other erosion-prevention and soil-improving practices have been used. On range lands flood waters have been diverted and spread over 300,000 acres.

Streambank protection, gully control, revegetation, sand dune control, and other practices are being applied as rapidly as technicians can plan the work. Realization of the value of conservation principles is confirmed by the fact that land users are expending $3 for each dollar spent by the Government.

The Cherokee Indians in North Carolina mountains participate at a rate of $5 to $1 in carrying out one of the most complete programs of proper land use in the country. Some of these people still use oxen for pulling a seeder with a fertilizer attachment. Yet the best varieties of hybrid seed are being used, and no cultivated field goes into the winter without a protective legume cover crop. Some pasture lands are so steep that lime and phosphate must be carried in buckets and scattered by hand; nevertheless, the most modern scientific recommendations for pasture mixtures and rotation of crops are followed.

On 7,200 Indian farms in Oklahoma operated under sound conservation principles, land users contribute at a ratio of $6 to $1. Even though the Navajos and Hopis have very limited means, they contribute hand labor and teams to the extent of $2 for each $1 expended by the Government on soil- and water-conservation projects.

The Indian lives close to the land. He understands working in harmony with natural forces, and when they are scientifically explained to him, he strengthens his natural competence in conservation practices. Many requests from tribes and Indian associations for assistance in saving and improving their land resources cannot be granted because of lack of professional personnel and other facilities.

Approbation of the soil conservation work was expressed in the report of the Hoover Committee on Indian Affairs:

> To deal with some of the serious erosion which has taken place and is continuing, soil-and-moisture conservation projects to rebuild badly eroded areas are carried out on Indian lands. * * * The results in rehabilitating devastated areas are impressive. There has been substantial progress not only in the techniques of conserving soil and moisture but also in Indian attitudes toward soil conservation. Originally they were hostile or at least uninterested. Now they have caught on, are anxious to have conservation work done, and in 1947 contributed 70 percent of the costs. The work should continue. The justification is the need for conservation.

Forest and Grass

The forest resources on approximately 16,000,000 acres of Indian lands are being managed in accordance with the principles of sustained yield. These resources play an important part in the economy of many tribes of Indians.

The Indians of the Menominee, Navajo, and Red Lake Reservations operate commercial tribal sawmills which enable them to obtain the full benefit of their forests through employment, opportunities to learn the skills of the lumber industry and income from the timber in terms of stumpage and profit. These enterprises, which utilized 41,400,000 board feet of timber last year, have been operated successfully. During the calendar year 1948, approximately 598,000,000 board feet of timber, with a value in excess of $4,800,000 were cut on Indian lands. The Indians cut 176,000,000 board feet with a value in excess of $1,000,000. The cash income to the Indians from the sale of timber was $4,597,676.

White pine blister rust continues to be a serious problem in the valuable stands of white pine on Indian lands in Minnesota and Wisconsin. Control projects have been conducted for a number of years in cooperation with the Bureau of Entomology and Plant Quarantine, Department of Agriculture, with a reasonable degree of success. During the past year a light infestation of the spruce bug worm occurred on 33,000 acres of Indian forests of the Northwest. This infestation has become very heavy in some sections of that area and endemic infestation of pine bark beetle continues to cause loss of timber on Indian lands.

Approximately 40,000,000 acres of Indian forest and range lands are under organized fire protection. During the past year, 827 forest and range fires burned over 118,088 acres; more than half were caused by lightning. The Fort Apache Reservation, Ariz., with its valuable stand of timber and rough terrain, presents a serious fire protection problem. Last year 28 percent of all fires and more than 40 percent of the damage to forest and range resources on Indian lands occurred on that reservation; 83 percent of these fires were caused by lightning.

Progress has been made in the management of Indian range resources. There are areas, however, in the Southwest which continue to be overgrazed because of lack of rainfall and heavy stocking. The situation is being improved gradually through necessary adjustments in stocking, improvements in the watering of livestock and range-use practices. During the calendar year, 44,000,000 acres of range lands provided about 9,000,000 cow-months of grazing. Of this area, 34,000,000 acres were used by Indians. The estimated value of the range resources utilized last year was in excess of $3,800,000. The cash income to the Indians was $1,710,000.

Irrigation

During the past fiscal year approximately 8,000 acres of land on the Colorado River Indian Reservation were subjugated and cropped, and canals and laterals built to supply the area with irrigation water. The primary purpose of the development is to provide farms for Navajo and Hopi Indians being colonized on the southern part of the reservation. At present 46 Navajo and Hopi families have been relocated on farms in the southern reserve. There are approximately 20,300 acres completely developed on the entire reservation. A large backlog of applications are on file from Navajo and Hopi families for irrigated land within the project, and 50,000 acres are being set aside for their use. The area has a year-around growing season and, when supplied with sufficient irrigation water, is exceptionally fertile. It is planned to develop the country as rapidly as possible, and, in coordination with the relocation of other Colorado River Basin Indians, it is believed that the rate of development for the next few years will be approximately 10,000 acres a year, provided funds are made available. Ultimately, farms will be provided for 1,250 families and employment created for 600 additional families.

On the Wapato irrigation project on the Yakima Indian Reservation, Wash., construction work for the development of approximately 9,000 acres of land on Satus unit No. 3 was also initiated during the fiscal year. Returning Indian war veterans have indicated a lively interest in the development which, when completed, will provide irrigated farms for approximately 250 families. The project is ideal from a water conservation standpoint because the water supply will be obtained by pumping the return flow from other project lands.

During the year construction work was also continued on irrigation projects on the Fort Peck, Navajo, United Pueblos, Wind River, and many small reservations; and activities were resumed on the Fort Hall Indian irrigation project in Idaho. On the Flathead irrigation project the construction of power-line extensions was accelerated but funds were not available in sufficient amounts to provide service to some 600 applicants.

On the Navajo Reservation surveys, investigations and designs were continued in cooperation with the Bureau of Reclamation for the proposed Shiprock project on the San Juan River.

Irrigation projects in all embrace about 838,000 acres of land of which 548,000 are Indian-owned and 290,000 are owned by non-Indians.

Three rural electrification districts are operating on energy obtained from Indian irrigation project supplies. The success of these power projects indicates clearly that Indian-owned power resources should be developed as soon as possible to aid in meeting the national power shortage and to aid also in repayment to the Treasury of reimbursable debts incurred for the construction of Indian irrigation projects.

The Hoover Committee on Indian Affairs pointed to the essential importance of Indian water rights. The report stated that Indian water rights should be used to the full and not allowed to lapse, adding that as one of the more valuable resources of Indian people, rights to water should be protected and the water used. While it pointed out that irrigation farming was a type of agriculture in which Indians had achieved limited success, the report stated:

> Climate, soil, and the necessities of a growing population dictate renewed effort to make the most of the opportunities in irrigated land. It is a means by which Indians can increase their income and find employment for their labor in passing from an extensive to an intensive agriculture. The vast Missouri River Basin development that is under way will provide water for millions of acres of newly irrigated land, some of it Indian-owned. This development provides a new and certain opportunity which Indians must not miss. A comprehensive and vigorous effort is needed to get results.

Roads

Before 1934 little had been done to develop adequate roads on Indian reservations. The few miles of roads or trails in existence were either State Highways crossing the Indian country for non-Indian through traffic, or primitive frontier-type roads and trails passable only during favorable weather.

During the years from 1933 to 1942 about 6,000 miles of roads were built, mostly of low standard. As part of the national CCC program, about 8,000 miles of truck trails and low standard roads were completed before the program was discontinued in 1942. During the war construction work ceased, except for roads for production of critical war materials, for which special funds were provided. The funds for regular Indian Service road maintenance were reduced to such an extent that adequate maintenance could not be provided for any part of the road system. The major effort since the war has been to rehabilitate the roads most important to the Indian people.

That substantial progress has been made toward providing Indians with roads and trails that will allow them to progress and will protect their resources is indicated by the 14,000 miles on which work has been done, but the rate of progress is behind that needed to implement all other Indian Service developments. At the present rate of appropriation grants, it will take some time to recoup the losses suffered during the war years. Regular maintenance has been brought back to a satisfactory standard and further loss of capital investment has been stopped.

Construction

Construction of buildings in Alaska this year has ranged from medical structures at farthest-north Point Barrow to the boarding school and health facilities being built near Sitka. Eight new day school and quarters buildings have been completed during the fiscal year. Remodeling and rehabilitation of the naval air station facilities on Japonski Island, Sitka Harbor, have been continued in order to further the conversion of this former naval base into the Mount Edgecumbe Boarding School. Work also has continued on the Army buildings on nearby Alice Island to convert these buildings to a 150-bed hospital and quarters.

Completion of the new 200-bed tuberculosis sanatorium at Mount Edgecumbe before the spring of 1950 is anticipated. Bids were received late in fiscal year for construction of a new 400-bed tuberculosis sanatorium and personnel housing in Anchorage but bids were too high to permit an award for the whole project. Health facilities in Alaska are also being increased by the construction of four tuberculosis custodial units adjacent to existing hospitals (Point Barrow, Bethel, Kanakanak, Kotzebue), which will allow for better care of advanced cases and relieve the adjacent hospitals of the burden imposed by the confinement of these patients.

A major problem throughout the country has been that of finding housing for employees at locations removed from urban areas. By remodeling buildings intended for other uses, moving houses from locations where they are no longer needed, and by new construction, it has been possible to complete about 35 new employees' housekeeping units. About 40 new units are under construction.

An adequate water supply is of primary importance in most of the Southwestern jurisdictions. To discover potential water-supply sources and to improve existing water supplies, the United States Geological Survey has begun a ground-water survey under the Bureau's supervision. Comprehensive surveys and reports have been completed at 14 stations on the Navajo Reservation. Test wells have been completed at five of these stations and three test wells have been developed into exceptionally good producing wells. It is expected that funds will be appropriated to continue this work.

During the year dormitory facilities for 60 elementary-school children on the Navajo Reservation were placed in operation, for 60 at the Coyote Canon Day School, and work was continued on the dormitories for the new Shiprock development. New schools were under construction at Bylas on the San Carlos Reservation and at Chuichu on the Papago Reservation. At the close of the year, plans were completed and bids were being solicited for a school for 270 pupils at Western Shoshone Agency, Owyhee, Nev., and for a school to be constructed in cooperation with the local school district at Roosevelt, Utah.

The Bureau has continued to emphasize the importance of safe water supply and effective sanitation. Some 19 major sanitary projects were under construction during the year. In a few cases it was necessary to omit desirable features in order to keep costs within available funds. In other cases it has been necessary to hold actual construction in abeyance until additional funds can be secured. In addition to these larger projects, smaller amounts have been made available for improvements to a number of existing facilities and for smaller installations.

EDUCATION FOR RESOURCES USE

Every survey of the work of the Bureau of Indian Affairs, both private and public, over the past quarter of a century has emphasized the central importance of education. The Meriam Survey of the 1920's contained more than 30 extended references to the problem of education. The latest report, the Hoover Committee on Indian Affairs, declared that:

> * * * education is an absolute essential; the need for it and the value of it cannot be doubted.

However, the report added:

> The real educational problem, and it is serious, is not in the areas where public authorities are able to take over. The real problem is in the area where children are not being educated in any schools—Indian Service, public or private.

The 1949 fiscal year ended with 19,300 Indian children of school age still without school facilities, despite the public agitation growing out of the discovery of the fact that the Navajo Reservation lacked schools for almost three-fourths of its school-age population; or about 15,000 children. Legislation was presented to the Eighty-first Congress to authorize construction of $25,000,000 in school facilities on or near the Navajo Reservation, but the justifications for this authorization made clear to all that this sum would provide facilities—added to the seats for approximately 5,000 children now available—to care for about half the children of school age. One major step forward was the authorization in January of the transfer of the Bushnell Army Hospital at Brigham City, Utah, to the Indian Service for remodeling into a school for Navajos, and the appropriation, in May, of $3,750,000 for the remodeling of these buildings to care for 2,000 children. Work was immediately begun, and it is planned to enroll between 500 and 600 children in January 1950, and have the entire plant ready for the total enrollment by midfall 1950.

During 1949, the enrollment of overage Navajos at nine off-reservation schools was increased to 2,173. The majority of these children are 12 years of age or older, and most of them are non-English speaking. An intensive 5-year program has been devised for these pupils which will teach them the English language, give them abilities in reading, arithmetic, health, and other content subjects; and train them in at least one marketable skill which should lead to employment in the areas where they are attending school. One of the major objectives of the program is to provide permanent settlement of these pupils away from the reservation when they have gained the training to become self-supporting.

Because the program is new, careful tests are given the children each year to measure their acquisition of spoken English and to determine the extent to which they are advancing in academic training. Despite the fact that these children began their work without a knowledge of the English language, they are relatively mature. The educational approach has been keyed to that maturity and the results show that the better children cover the work of three academic grades in 1 year; that with few exceptions all of the children covered the work of at least one academic year, and also gained reasonable fluency in the use of English.

During the years, the Papagos of southern Arizona, who have never been in conflict with their white neighbors, emphasized that the Federal Government, which began to build schools for them only in 1915, has left the job only half done. About 600 of their 1,200 children are still out of school. In the Papago program to be submitted to the Congress, they call attention to the fact that many Papago families, in order to remain self-supporting must seek seasonal work away from the reservation. They naturally take their children with them, and frequently find work where there are no nearby public schools. As a result, the schooling of their children is interrupted. They ask for dormitories near their elementary day schools where they can leave their children to get an education while they are away earning a living.

Reports from Alaska indicate that there are still almost 2,000 children living in native villages where no schools have been built. The early completion of the two great sanatoria for tubercular natives at Mount Edgecumbe (200 beds) and Anchorage (400 beds), raises another and unforeseen problem. Most of the known active cases of tuberculosis among the natives, who should be hospitalized, are parents who object seriously to leaving their children in the care of relatives or friends while the parents are at the hospital. They insist that the Government provide a satisfactory boarding school for these children, until such time as the families can be reunited. Plans, therefore, are being laid for the rebuilding of the former Eklutna School in or near Palmer in the Matanuska Valley.

The present total of Indian children of school age is estimated to be approximately 92,000 (in continental United States). Almost 32,000 are enrolled in public schools near their homes; a little over 27,000 are in Federal boarding and day schools (about half in each type); 7,800 are in mission schools; almost 6,000 are "unaccounted for"—most of them children of families which have left their reservations for employment. The remainder are still without schools.

It is estimated that there are 10,457 children of school age in Alaska; 2,700 of these are in Territorial public schools; about 5,260 are in 3 Federal boarding and 91 day schools; about 600 in private and mission schools; and almost 2,000 without local school facilities. The new Federal boarding high school at Mount Edgecumbe near Sitka opened in 1948, is now overenrolled with more than 600 students. The 1950 appropriation act carries funds for the enlargement to 200 pupils of the White Mountain Eskimo High School near Nome.

As many Indian children attending public schools live on nontaxable Indian lands in districts with limited resources, the Federal Government assists these districts financially, in a majority of cases through contracts with the State departments of education. During the last few years, contracts have been drawn with 13 States for a total of 20,637 children in 1949.

During 1949, the Indian Bureau operated nonreservation boarding schools for 6,607 Indian children and 20 reservation boarding schools and 190 day schools enrolling 3,386 children in the United States. Limited appropriations necessitated dropping about 500 children from Federal boarding schools in the States and 11 day schools remained closed in Alaska.

For the last 3 years, teachers' salaries in the States where the Indian Service operates schools have increased more rapidly than Federal salaries. As a result of this difference, and the Nation-wide elementary teacher shortage, it has been difficult for the Indian Service to obtain qualified personnel. A recent civil service examination established the first teacher register since 1942. The education positions of the Indian Service were also reviewed by the Civil Service Commission, which classified teachers in professional grades. The Bureau is requesting funds to make this new classification effective in the 1951 budget.

> The two basic needs of Indian people are education and assistance in strengthening their economic position.

the Hoover Committee on Indian Affairs found—

> All the evidence available, past and present, points to the value of education—general education and vocational education. Indians themselves, old and young, full-bloods and mixed-bloods, believe education is essential to the advancement of their people. Economic assistance is ranked with education in importance in all Indian groups and the facts support these views. Indian resources are not

fully developed on most reservations, and a substantial portion of their lands are being leased to others rather than grazed or farmed by Indian operators. To make the most effective and the most profitable use of their resources Indians need technical assistance and they need capital. Indians with inadequate resources or with no resources need assistance in getting off-reservation employment. They need training to increase or to give them new skills. Men with families need financial assistance in relocating and all who are to break away from the reservation can profit from guidance. All of the reservation Indian's friends and family are concentrated on the reservation. He does not have friends and relatives elsewhere who can help him find the openings or learn the ropes. Only the man who is entirely without "contacts" can realize how valuable they are to him and how much he relies upon them.

The basic needs of education and economic assistance are interrelated. Education is a means of increasing earning power, and an adequate family income is essential to a satisfactory educational program for children. Other needs, such as an adequate health and medical program, are important; some of them are essential; but they are, in a sense, auxiliary to the basic educational and economic requirements for progress. * * * The cost of educating Indian children will be heavy until at least one full generation has been well educated, but the cost of not educating them is greater still. Although a deferred cost and a concealed cost, it would have to be met in health costs, relief costs, law and order costs and the continuance of the "Indian problem."

Health

A serious deficiency facing Indians is poor health. The basic cause lies in the poor economic conditions, with resultant poor diets, sanitation, and housing.

As the most urgent step to improve the health of Indians, the Bureau of Indian Affairs has begun an all-out attack on tuberculosis, the greatest menace. Following tuberculosis are infant diseases and pneumonia. The tuberculosis death rate in 1912 per 100,000 was 1,040 among the Indians and 145.4 among the general population. The death rate has gradually decreased so that in 1945 comparable rates were 211.9 per 100,000 among Indians and 40.1 in the general population. From 1946 to 1949 there has been no appreciable decrease in the death rate among the Indians while among the general population the trend has been declining to the present rate of 34.6 deaths per 100,000 individuals. Of a total of 29,487 Indians X-rayed in 1948 with the photofluorographic units in the field, 3.2 percent showed significant disease. It is recognized that fundamentally an improvement in the socioeconomic status of the Indian must take place before tuberculosis can be completely controlled. In the meantime the generally accepted control measures are in use to the extent of available funds and personnel.

In 1935, the Bureau of Indian Affairs began a study of the efficacy of B. C. G. vaccine (Bacillus Calmette-Guerin) and continued the study for 14 years. At the end of this period an analysis of the results showed that the number of tuberculosis cases found among the vaccinated is almost insignificant. As a result of this and other studies, it was decided to vaccinate all school children negative to the tuberculin test. In the spring of 1949, within a 3-month period, 192 schools were visited and in 180 the program was completed. The other 12 schools could not be examined because of the existence of communicable diseases such as measles. The 8 teams examined 17,000 students and vaccinated 6,000. It is planned to continue the program in fiscal year 1950.

The tuberculosis case-finding program consists principally of two photofluorographic X-rays. Hospitalization of cases needing treatment has proceeded to the extent of operating funds available to the sanatoria and to cover contracts. There is an urgent need for expansion in this segment of the health program, if tuberculosis is to be controlled.

Progress has been made in organizing health programs on an agency basis to supplement the existing public health nursing activities by improving public water supplies; the sanitary disposal of sewage; the control of flies and fly-borne diseases through DDT spraying programs; the inspection and improvement of sanitary facilities at Indian Service schools, dormitories, and boarding schools and provisions for maternal and child hygiene services.

Two medical teams of the American Medical Association surveyed the Bureau of Indian Affairs health service in Alaska and the upper Midwest during fiscal year 1949. Their general recommendations were expansion of tuberculosis control activities; establishment of residencies for cases of tuberculosis, thoracic surgery and orthopedics; additional hospital beds for tuberculosis and orthopedics; closer integration of public health and disease prevention programs with the States and the Territory of Alaska; improvement in housing and sanitation; improvement of the living conditions of Indians; increased budgets for health purposes; more public health nurses; expansion of contracts for medical and public health services and more health education and improvement of hospitalization.

The Bureau operated 64 hospitals during fiscal year 1949. Hospital activity was conducted at a minimum level because of lack of operating funds and inability to obtain personnel because of the low salary scale paid to medical officers and other personnel. The work was limited to emergency cases with elective surgery being deferred. The situation in regard to tuberculosis hospitals is grave. Large numbers of individuals seeking admission could not be accepted because of insufficiency of beds and of operating funds and personnel even for existing beds. At one of the State hospitals where 118 beds were provided by the Bureau, operating funds were only sufficient to maintain an average daily load of about 50 patients. The inadequacy in hospitalization must be remedied if disastrous results are to be avoided since many of the cases of elective surgery will proceed to become emergency or hopeless cases through lack of attention. The tuberculosis problem will be increased because of the exposure of individuals of the community to the open cases that cannot now be hospitalized or isolated. To attack the prbolem of tuberculosis control adequately would require operation of all existing beds now available plus an additional 1,200 to 1,400 to be acquired by construction or through contracts in the States and the completion of the program now authorized in Alaska. Not less than $11,000,000 annually will be necessary for a number of years to control tuberculosis only. At present approximately $2,400,000 is available. If a vigorous attack is pursued within one generation the problem of tuberculosis can almost be eliminated.

All of the facts that have been considered—lack of resources, lack of training, health deficiencies—combine to make it difficult for Indians either to survive in their home environments or to establish themselves in communities where opportunity is richer. Behavior of people in communities where Indians seek labor often belies their verbally sympathetic attitudes. The people retain some traditional suspicion of the Indian based on childhood stories, or persist in repeating clichés about Indian work habits and responsibility that indicate little understanding of the Indian as a human being, an American citizen, or a veteran of the recent war. These attitudes do not encourage the Indians to continue in the nonreservation community. They add to the discouragement produced by his lack of training and his reluctance to break the ties to his home—the reservation.

> It is in the public interest and in the interest of the Indian—

the final report of the Hoover Committee stated—

> to see that Indian people fit into the economic and social structure of the country at a sufficiently high level to enjoy the benefits of American society and that each Indian is able to find a place that has some reasonable relation to his ability and resources. * * * Regardless of treaties and agreements with Indian tribes in which a good many specific commitments have been made as to both educational and economic assistance toward assimilation, the Indian deserves at least a fair break because he is a human being and a citizen of the United States. If a disproportionate number of Indian people are forced to take a position at the bottom of the economic ladder, public policy will have failed; and if the stress and strain of moving from the old cultural base to the new is such as to take the joy out of life, to produce a general feeling of inferiority, and to destroy drive and purpose, the process of assimilation will have been unsatisfactory.

Arts and Crafts

Their arts, crafts, and manual industries provide a significant supplemental income to hundreds of Indian families. Even more important, the income from crafts is greatest among the poorest Indians. In some areas the sales of products of their craftsmanship represent practically the only cash income received by the Indians. Potentially, arts, crafts, and manual industries constitute one of the most promising sources of income available to them.

The Indian Arts and Crafts Board has the responsibility of stimulating production, organizing production and marketing agencies, improving quality and standards, and assisting in establishing marketing outlets.

In Alaska, the manufacture of skin and fur garments and the carving of ivory are the principal crafts. During the past year a group of seven Eskimos went to Taxco, Mexico, to work with William Spratling, widely known producer of fine silver and gold jewelry. Spratling and the Eskimo craftsmen designed and produced 200 pieces of jewelry to serve as models to the craftsmen of Alaska. These were beautifully designed and executed, combining ivory with various materials available to Alaska craftsmen—silver, jade, gold, baleen, abalone, and lapis lazuli. Many of the pieces incorporated traditional Alaska designs. These models were displayed in the Indian Office and in the Departmental Museum, and finally sent to Alaska where they will serve to bring new ideas of design and craftsmanship to the Eskimos and Indians of southeast Alaska.

In the Southwest, Navajo and Pueblo silver jewelry, Navajo rugs, Pueblo pottery, and Hopi, Pima, and Papago baskets are best known. In spite of the tremendous sale of manufactured imitations, Indian craftsmen during the past year produced more high-quality handmade silver jewelry than in any previous year. Progress was made in both design and workmanship. Toward the end of the year there was a noticeable change in the market. Buyers avoided the most expensive items and shopped cautiously, but sales of good items held up well.

During the year reconstituted turquoise appeared in considerable volume in the market and was widely used in manufactured Indian-design jewelry. The availability of these cheap imitation stones was quite tempting to Indian silversmiths. A piece of jewelry set with reconstituted turquoise could be passed off on the unsuspecting tourist, netting the silversmith quite a little additional income. The board and the traders association felt that one of the advantages the Indian craftsmen have is the confidence of the buying public in the genuineness of the Indian-made product. Any compromise with this standard would deprive the craftsmen of this advantage and put him into direct competition with machines. They therefore urge Indian silversmiths to continue to use genuine stones. The imitation stones nevertheless consitute a threat to the whole future of Indian handmade jewelry.

A group of Hopi, having completed a GI course in silversmithing, have set themselves up at Oraibi, the first guild of Hopi silversmiths. They are producing silver jewelry with ancient Hopi designs adapted from their pottery. Two San Ildefonso smiths have made similar adaptations in their village.

In western Oklahoma, a new development within the past year promises to become an important manual industry. The Inter-Tribal Crafts Association has adapted for modern wear some of the traditional costumes of the Southern Plains Indians. These are being produced in good modern fabrics. Sewers, silversmiths, and bead workers are all employed in the production of these costumes and accessories. Outlets have been established in Oklahoma; Taos, Santa Fe, and Los Alamos, N. Mex.; and Tucson, Ariz.

In the Northern Plains area, there is a federation of several small producing groups. They maintain a wholesale office and warehouse in Billings, Mont., and operate several local shops, the most important being the one in the museum of the Northern Plains Indians at Browning, Mont. This organization produces a variety of crafts—buckskin jackets, dolls, moccasins, bags, purses, and blankets.

The Qualla Cooperative of the Cherokees of western North Carolina opened its new store during the spring. The tribe was embarked on an ambitious tourist project which includes a motor court, a dining lodge, a filling station, and the craft shop, all located at Boundary Tree on the border between the reservation and the Great Smoky National Park. This store, carrying only high-quality Cherokee crafts, has already stimulated an enlarged volume of good products. Baskets of both cane and spliced oak, handsome hand-made bowls from the beautiful woods of the mountains, wrought-iron work, carved wooden animals, and hand-woven luncheon sets, and rugs are the outstanding items being shown.

Indian arts and crafts suffer from inadequate financing. Production is too often kept below the point of good business operation. Manual industries can be developed into significant economic opportunities for Indians if credit is available to assist in financing them.

Welfare

During the winter months of January and February severe snowstorms ravaged the Indian reservations throughout the Middle West and the western part of the Navajo Reservation. The Bureau mobilized all available resources to bring relief to stranded individuals and families, to communities, and to livestock.

All personnel involved in the operation acted in such a manner as to make possible the close and effective teamwork required for success. One hundred and nine Navajo Indians worked night and day without complaint to bring relief to their fellow tribesmen in distress. Road-clearing crews and truckers worked long hours under conditions of extreme hardship. Air guides and spotters accepted their tiresome and hazardous duties and performed them uncomplainingly. Men in charge of the various phases of the operation discharged their heavy responsibilities in a most highly commendable manner.

The same must be said of the many representatives of non-Indian Service organizations who participated. Army and Navy pilots and crews worked side by side with Indian Service personnel in the airlift operation. Civilian employees of the Phoenix and Winslow Airports devoted themselves to this emergency as though it were directly their own responsibility. The police departments of the two cities gave their fullest cooperation. Many of the policemen voluntarily leapt to the task of loading when there was delay due to insufficient help. The Red Cross not only furnished the immediate financial assistance but stood "at alert" at all times to render all aid within the resources of that humanitarian organization.

Due to the unprecedentedly severe and prolonged snowstorms, the number of persons needing assistance increased. Relief funds were quickly spent, and supplemental appropriations were necessary.

THE LEGAL RECORD

At the beginning of the fiscal year judicial decisions in the States of New Mexico and Arizona removed the last legal barrier to suffrage for Indians in the United States. These decisions were summarized in the last annual report. One-fourth of the Indians in the United States were thus enfranchised. As a result, several thousand Indians in these States cast their first ballots in the Presidential election in 1948. The Legislature of the State of New Mexico passed a bill which would have disenfranchised Indians living on reservations. This measure was not signed by the Governor.

In addition to assisting in the amicus curiae briefs filed by the Civil Rights Section of the Criminal Division of the Department of Justice in the two voting cases in the States of New Mexico and Arizona, the Bureau's legal staff also assisted in the preparation of material relative to the adverse effect of restrictive covenants on American Indian and Territorial policy. This argument was the main basis for the Department urging the Attorney General for filing a brief amicus curiae in the restrictive covenants cases.

In *Mapatis et al.* v. *Ewing*, *et al.*, several Indians on Indian reservations in the States of New Mexico and Arizona instituted suit in the District Court of the District of Columbia against the Federal Security Administrator, the Secretary of the Interior, the Secretary of the Treasury, and the Comptroller General seeking an injunction and declaratory judgment to insure to the reservation Indians in these States equal social-security benefits with members of other races in these States. The suit was dismissed after the end of the fiscal year with the consent of the plaintiffs without prejudice.

Several events occurred which give promise of further amendments to the Indian liquor law. A vote was taken on the floor of the House of Representatives on a proposal that an experiment be made of repealing the Indian liquor law in a State or two. This measure was defeated. In the revision of title 18 of the United States Code relating to criminal laws, Indians are permitted to use intoxicating liquor for mechanical, scientific, and medicinal purposes, in addition to the previous permission of use for sacramental purposes.

Protection of Indian Property Rights

After pending in the Federal courts for almost 3 years, the case of *Frank Hynes* v. *Grimes Packing Company et al.*, was concluded on May 31, 1949, by a decision of the Supreme Court of the United States. This action was begun in the District Court of Alaska in June 1946 by attorneys of seven packing companies. All but one were members of the Alaska canned salmon industry, comprising most of the salmon fishing and canning companies in the Territory. This trade association has maintained for many years that the Secretary's action in 1943, of including 3,000 feet of ocean waters in the Karluk Indian Reservation was illegal, and that the Alaska Indian Welfare Act of 1936 only permitted reservations to be formed from uplands or dry lands.

The suit sought to have declared invalid Public Land Order No. 120, which established the reserve, and to enjoin the regional director of the Fish and Wildlife Service from enforcing, by criminal proceedings, a rule adopted under the White Act which authorizes the Secretary of the Interior to regulate the commercial fisheries of Alaska. The secretarial regulation, approved in March 1946, prohibited trespassers from fishing in the waters of the Karluk Indian Reservation.

The Supreme Court held unanimously that the Secretary of the Interior could include tidelands and coastal waters to a distance of 3,000 feet from the shore within the boundary of an Indian reservation in Alaska. On the subsidiary point, the Justices, by a vote of 5 to 4, held that the Secretary of the Interior cannot properly apply the penalties provided in the White Act to trespassers fishing in reservation waters without the consent of the Indians because White Act penalties, such as the seizure of boats or gear used in illegal fishing, are applicable only to White Act violations. The Court pointed out, however, that persons entering the reservation waters without permission of the natives were trespassers and subject to such limitations as were necessary to prevent or redress their wrongful entry.

In the trial court, District Judge Pratt, of Alaska, refused to permit the Government to introduce any evidence that the Indians had used and occupied the lands and waters of the reservation from time immemorial. The Supreme Court, therefore, considered the case as if the Indians had no possessory rights, and the Secretary had established for them a reserve of public lands and waters under the Alaska Indian Welfare Act of 1936. The Court stated that the Congress and the President could rescind such reserve without the consent of the Indians and without making the Federal Government liable for compensation to the Indians.

Increased activity in the prosecution of tribal claims is the result of the establishment of the Indian Claims Commission in 1947 and the approval of numerous attorney contracts with the Indian tribes, bands, and groups. About 65 attorney contracts for the prosecution of tribal claims were approved during the last year. Forty-nine petitions have been filed in the Indian Claims Commission, as well as reports on petitions filed in the Court of Claims. These cases involve the claims of the Ute Indians for their lands in Colorado and for claims of the Osage Indians, Western Cherokee Indians, Texas Cherokee Indians, California Indians, Loyal Creek Indians, Nooksack Indians, and the Mole Lake Band of Chippewa Indians.

During the past year many of the Indian tribes have employed attorneys to act as general counsel to furnish legal advice to promote and protect their interests and welfare. Twenty-two general counsel contracts were approved during the last year.

NATIONAL ADVISORY COMMITTEE ON INDIAN AFFAIRS

On January 6, 1949, Secretary of the Interior J. A. Krug announced the appointment of a National Advisory Committee on Indian Affairs to advise and consult with the Secretary and officials of the Bureau of Indian Affairs on administrative policies relating to American Indians.

Membership of the Committee included: Mark A. Dawber, executive secretary, Home Missions Council of North America, Inc., New York City; Olive LaFarge, president, Association on American Indian Affairs, Inc., Santa Fe, N. Mex.; Jonathan M. Steere, president, Indian Rights Association, Philadelphia; Ruth M. Bronson, then executive secretary, National Congress of American Indians, Washington, D. C.; E. P. Carville, former Nevada Governor and United States Senator, Reno, Nev.; W. Carson Ryan, professor, department of education, University of North Carolina, Chapel Hill, N. C.; Clyde Kluckhohn, professor, department of anthropology, Harvard University, Cambridge, Mass.; Roland R. Renne, president, Montana State College, Bozeman, Mont.; Ruth Kirk, chairman, Indian Committee, General Federation of Women's Clubs, Gallup, N. Mex.; Barry Goldwater, president, Goldwater Department Store, Phoenix, Ariz.; and Louis R. Bruce, Jr., dairy farmer, recently elected secretary of the National Congress of American Indians, Richfield Springs, N. Y.

Among the subjects discussed at the first meeting of the Committee on February 1, 1949, were the Department's legislative program for Indian affairs in the Eighty-first Congress, the Navajo-Hopi long-range program, the Alaska native problems, a public-health program for Indians, comprehensive reservation programs, and an information program designed to lessen ignorance and misunderstanding of the conditions of life and status of American Indians. On the last point, the advisory committee said:

> This ignorance and misunderstanding promote prejudice and discrimination against Indians and hamper adjustment between them and their non-Indian neighbors. They prevent effective legislative and administrative development of constructive Federal, State, or local Indian programs, and thereby impair efficiency and morale of the Indian Service and of all others actively at work to improve Indian conditions.

The Committee met upon two other occasions before the end of the fiscal year, in March and in May. Its agenda included numerous subjects ranging from protection of Alaska native rights to scholarships for worthy Indian youths.

During June 1949, Secretary Krug, in asking for statutory authorization for the Committee, reported to the Congress that—

> The members, with their different viewpoints, have been able to bring to the Department objective and impartial advice and criticism. They have given the officials of the Department and the Bureau of Indian Affairs a clearer understanding of the attitudes and views of the informed public.

The members of the Committee serve without compensation, and to date, have paid the expenses necessary for attending meetings in Washington. A bill (H. R. 4755) to compensate Committee members for travel and other expenses passed the House of Representatives during the closing days of the Eighty-first Congress, first session.

Present plans call for an average of three meetings a year.

TRIBAL RELATIONS

Before the coming of the white man all Indian tribes were self-governing. Self-government itself has been a tradition of democratic America, stemming in great part from the ancient self-government of Indian tribes. Incorporated towns and cities are organized under corporate charters in accordance with the laws of the several States; as Indian reservation lands are under Federal supervision, it is appropriate that Indian communities should be incorporated under Federal law. For many years, however, the Indian Service administered the reservations in complete disregard of tribal authority. Today the Indian Reorganization Act extends to Indian communities substantially the same power of self-government that is possessed by the average American town. It provides a means of transferring local self-government back to the Indian people.

Tribal councils may pass ordinances covering subjects similar to those dealt with by municipal or county boards of commissioners. Indian tribal courts deal with misdemeanors and civil actions similar to those heard in municipal courts or in the offices of justices of the peace.

Most tribal constitutions provide that the Secretary of the Interior must approve certain types of ordinances—usually those involving money transactions, law and order, choice of legal counsel, or regulations affecting non-Indians. The tribal charter, as distinguished from the constitution, limits Secretarial review to a term of years, usually 5 or 10. Many of the tribes which adopted charters between 1936 and 1939 have passed the 10-year mark and are now legally able to terminate Secretarial review by vote of the tribe.

Most of the 178 tribal constitutions and 152 corporate charters which are in operation in the States and in Alaska were adopted within 5 years after the passage of the Indian Reorganization Act. However, each year additional tribes see fit to adopt organization documents. During the past year, three native villages in Alaska and two tribes in the States adopted constitutions and the Alaska village ratified corporate charters, in addition. Five tribes have adopted amendments either to their constitutions or corporate charters, or both. The Klamath tribe voted on a constitution, but rejected it by a vote of 309 to 102.

Many tribes each year send representatives to Washington to transact business with committees of the Congress and with the Bureau. The Fort Berthold tribes of North Dakota negotiated a contract with the Army Engineers and conferred with members of Congress in connection with land to be inundated when construction of Garrison Dam across the Missouri River is completed. The Kiowa, Comanche, and Apache tribes of Oklahoma appeared before the subcommittee on Indian Affairs of the House Public Lands Committee to oppose the passage of House bill 4877, a bill to confer jurisdiction upon the United States District Court in condemnation proceedings proposed by the city of Lawton, Okla., for the acquisition of a tract of land title to which is held in trust by the United States for these tribes. The Pyramid Lake Paiute tribe of Nevada opposed the passage of Senate bill 17. This bill would direct the Secretary of the Interior to sell certain lands in the Pyramid Lake Indian Reservation.

Tribes organized under the Indian Reorganization Act obtain revenue from various sources and may deposit income in commercial banks or with a bonded disbursing officer, as they may choose. Expenditures from such tribal funds are made in accordance with the provisions of the tribe's constitution and charter. Prior to the passage of the Indian Reorganization Act, all tribal revenues were deposited in the United States Treasury and were not available for expending, except when appropriated by Congress. The tribe was first required to make its wishes known to the Secretary of the Interior who would submit the request to Congress. If Congress felt the expenditure justified, it appropriated funds, which were later allotted by the Secretary to the reservation superintendent and disbursed by him in accordance with the regulations governing the expenditure of appropriated public funds.

In 1949, the tribes of the Blackfeet and Flathead Reservations in Montana, and the tribes of the Fort Apache and San Carlos Reservations in Arizona, operated under annual tribal budgets involving the expenditures of over $450,000 each from funds deposited in local banks or Federal depositories. The San Carlos Apache tribe, which derives its income principally from cattle, had an annual budget of $470,827.08. Of this amount, approximately $100,000 was spent for salaries of regular tribal employees and irregular labor. Tribal enterprises provide employment opportunities for tribal members, as clerks, stenographers, stockmen, range riders, round-up crews, laborers, carpenters, and tribal store managers.

THE GOAL

The United States has two responsibilities toward the Indian people: to protect their property, and to provide services not otherwise available to them. The Government's protective function was not imposed. It was an obligation assumed in part payment for value received. The "Indian problem" that all of us face—Indians and non-Indians alike—is to develop to the utmost such resources of the Indians as are capable of development, and to provide safeguards to insure the continued right of use so long as the resources are needed. As a coordinate of this program, the Government must intensify its efforts to train Indians, to secure them in good health, and to work toward placing them in communities where they can support themselves, when such support cannot be obtained in the reservation areas. The ultimate purpose of Indian policy is to attain that objective stated by Thomas Jefferson:

> The ultimate point of rest and happiness for them (the Indians) is to let our settlements and theirs meet and blend together, to intermix, and become one people.

* * * * * * *

Office of the Solicitor

Mastin G. White, *Solicitor*

* * *

GENERAL.—The departmental regulations governing appearances by former officers or employees of the Department as practitioners before the Department were revised.

Changes were made in the rules relating to the giving of testimony by employees of the Department before courts or administrative tribunals concerning official matters.

This office cooperated with other agencies of the Department in effecting the changes in procedures and regulations that were necessitated by a revision of the Federal Register regulations and the prospective publication of the 1949 edition of the Code of Federal Regulations.

APPEALS.—Much time and effort were devoted by personnel of the office to the disposition of formal appeals that had been taken to the head of the Department from decisions previously rendered by bureau officials. During the fiscal year, 719 of these appeals were disposed of by the Office of the Solicitor. However, approximately 360 of them were appeals which involved applications for oil and gas leases on submerged coastal lands and which were disposed of on the basis of a key decision holding that submerged coastal lands are not subject to leasing for oil and gas development under existing law.

Some of the more important rulings made in disposing of appeals are summarized below:

The Texas Co. (A–24562).—Although the ownership by the Government of land abutting a nonnavigable stream in Montana vests in the Government title to the contiguous land in the bed of the stream to its center line, an oil and gas lease issued by the Government on the former land covers only the land specifically described in the lease and does not convey any right to take oil and gas from the contiguous land owned by the Government in the bed of the stream.

David H. Gustaveson (A–24624).—The privilege of applying for and receiving an oil and gas lease on public land is not assignable, and the Department will not assume jurisdiction over a controversy as to whether persons other than the applicant for a lease have an interest in the application.

United States v. *Crocker* (A–24666).—The submission of a proposal by the supervisor of a national forest that an area within the forest be established as an administrative site, the surveying of the area, and the filing of the survey notes and proposal in the regional office of the Forest Service were insufficient to effect a withdrawal from mining location of the unimproved land within the area.

Harold Toplon et al. (A–24673).—Although Mexican land grants did not convey the minerals in the land to the grantees, patents issued by the United States in confirmation of Mexican land grants divested the United States of its interest in the minerals, there being no express reservation of minerals in the patents issued by the Government.

Ada Maxam (A–24710).—The establishment and maintenance of a residence upon public land under the homestead laws involve a combination of act and intent—the act of occupying and living upon the land involved in the claim, and the intent of making the place a home to the exclusion of a home elsewhere.

State of California (A–25127).—Where a State has endeavored to make an indemnity selection for the benefit of a resident of the State and the application has been denied by the Director of the Bureau of Land Management, the proposed beneficiary of the selection does not have any standing to appeal to the head of the Department from the Director's decision.

Estate of Grant Gover (A–25208).—In the absence of controlling Federal legislation, the marriages of Indians living in tribal relations may be contracted and dissolved in accordance with Indian custom, except to the extent that the Indians themselves, by formal tribal action, have adopted the requirements of State law as their own.

The purported marriage of two unallotted Pawnee Indians who were first cousins of the half blood was void under the custom of the tribe and also under the law of Oklahoma, so that the survivor, at the death of one of the parties, did not have any right by virtue of the purported marriage to share in the estate of the decedent.

Pollak and Eckloff (A–25300).—An Executive order setting aside public land "as a grazing reservation for the Indians of the Walker River Reservation" vested in the Indians of the reservation full Indian title to such land, and not merely the privilege of using the land for grazing purposes.

Starks v. *Mackey; Starks* v. *Black* (A–25351; A–25374).—A recital in a notice of location or in a validating certificate to the effect that a valid mineral discovery has been made by the mineral locator is not evidence of a discovery.

A mining claimant who institutes a contest against the issuance of an oil and gas lease on land which includes the claim has the burden of proving the validity of the claim.

Testimony showing that a 3-foot layer of oily, greasy shale was discovered 2 feet below the surface of a mining claim falls short of establishing that a discovery of oil sufficient to validate the claim was made.

Elbert O. Jensen (A–25352).—The "public interests" to be benefited by exchanges under section 8 (b) of the Taylor Grazing Act may encompass interests outside the grazing district involved in an exchange.

E. A. Wight (A–25408).—An application for an oil and gas lease which was improperly submitted to the Washington office of the Bureau of Land Management instead of being filed in the appropriate district land office must be regarded as subordinate to a conflicting application which was properly filed in the district land office subsequent to the date when the first application was received in Washington but prior to the date when it was received in the district land office.

State of California (A–25411).—A State applying for an exchange of lands does not, prior to complying fully with the governing statute and the supplementary regulations of this Department, acquire any rights in the selected lands, so as to prevent the withdrawal of such lands for public purposes.

Luna C. Wooten (A–25424).—Where an oil and gas lease has been divided by approved assignments, the several portions become separate leases for all purposes, and the subsequent discovery and production of oil or gas on one area do not inure to the benefit of any other area.

Estate of Belle Cozad (A–25428).—The period of limitations within which a petition for the reopening of Indian probate proceedings must be filed is applicable to minors and adults alike.

Allen A. Daley (A–25575).—The Department of the Interior cannot review a determination made by the Administrator of Civil Aeronautics that a particular tract of public land is reasonably necessary for airport purposes.

Marie Williams (A–25635).—An oil and gas field in which production from certain formations has ended has not thereby ceased to be a "producing oil or gas field" if there are reasonable prospects of production from other formations in the field. Public lands within such a field are not subject to noncompetitive leasing under the Mineral Leasing Act, but can only be leased on a competitive basis.

Opinions.—The Solicitor rendered 77 formal legal opinions during the fiscal year. The variety of the legal questions answered in these opinions is indicated by the following references to some of the opinions:

M–34963: Park areas in the District of Columbia which have been designated by the National Capital Park and Planning Commission for use as playgrounds are still subject to the jurisdiction of the Secretary of the Interior, and the continued use of such areas for playground purposes is contingent upon the making of an agreement to that end by the District of Columbia Recreation Board with the Secretary.

M–35044: The Secretary of the Interior has the authority to extend the boundaries of the existing Everglades National Park, but the

Secretary has no power to cause condemnation proceedings to be instituted against privately owned lands, either within or outside the present park boundaries, in order to acquire such lands for the park.

M–35049: The departmental order of September 19, 1934, temporarily withdrawing the surplus lands of the Colville Indian Reservation from disposal of any kind, was issued under the implied power of the Secretary of the Interior to withdraw such lands, rather than under the act of June 25, 1910, and, hence, the lands so withdrawn are not subject to the provision of the 1910 act which declares that lands withdrawn under it shall be open to entry and location under the mining laws of the United States insofar as metalliferous minerals are concerned.

M–35067: A California statute imposing restrictions on the acquisition of land in that State by Federal agencies does not apply to the acquisition of a tract of land where only title to the land is obtained by the United States and where no transfer of jurisdiction, either exclusive or partial, over the land is sought by the Federal Government.

M–35078: The Secretary of the Interior cannot properly delegate to an official of another Government department functions that are vested by law in the Secretary of the Interior.

M–35088: Persons who hold appointments in this Department as consultants without compensation are "officers" or "employees" of the Department within the meaning of the criminal statutes which impose prohibitions on officers or employees of governmental agencies.

M–35090: The Secretary of the Interior is authorized by section 9 of the Boulder Canyon Project Act to open to entry only those public lands which he finds are "practicable of irrigation and reclamation"; and a determination made by one Secretary that an area is "practicable of irrigation and reclamation" does not prevent a subsequent Secretary from reversing the earlier finding on the basis of later and more adequate data.

M–35095: The statutory provision authorizing the Secretary of the Interior to make contracts with States "for the * * * social welfare, including relief of distress, of Indians" is sufficiently broad to cover an agreement with a State for the furnishing by the State to Indians on reservations of old-age assistance, aid to the needy blind, and aid to dependent children, which are the types of assistance contemplated by the Social Security Act.

M–35099: An employee of the Department cannot be given both a cash award and a within-grade advancement for a suggestion which he has made and which has been adopted by the Department.

P–43: In the case of an employee of this Department who made an invention while on leave for the performance of military duty with the United States Army, the question of the respective rights of the Government and of the employee in the invention should be determined on the basis of the Army Regulations, rather than on the basis of the regulations of this Department.

Claims.—The regional counsels of the Bureau of Land Management and the counsel for The Alaska Railroad were added to the list of field attorneys empowered to determine claims under the Federal Tort Claims Act, and the authority of all field attorneys exercising this power was enlarged so that they might pass upon claims for amounts up to $1,000. Claimants who are dissatisfied with the decisions rendered by field attorneys under the Federal Tort Claims Act may appeal to the Solicitor.

The regional counsels of the Bureau of Reclamation and of the Bureau of Indian Affairs were authorized to consider and dispose of claims in the amount of $1,000 or less for damages allegedly arising out of the survey, construction, operation, or maintenance of irrigation works. Determinations made by these attorneys on irrigation claims may be appealed to the Solicitor.

Some of the more important decisions rendered by the Solicitor in disposing of tort and irrigation claims during the fiscal year are mentioned below:

James Purdon and Mary Purdon (M–34113).—Funds appropriated "for payment of claims for damage to * * * property * * * arising out of the survey, construction, operation or maintenance" of irrigation works may properly be used to compensate a claimant because of damage to property resulting from the escape of irrigation water through seepage.

Queen Insurance Co. (M–34551).—The period of limitations under which an insurer-subrogee may file a claim under the Federal Tort Claims Act begins to run on the same date as the period of limitations with respect to the claim of the insured.

M. H. North (T–102 (Ir.)).—Funds appropriated "for payment of claims for damage to * * * property * * * arising out of the survey, construction, operation or maintenance" of irrigation works cannot properly be used to compensate a claimant because of damage to property resulting from a rise in the ground water table within the surrounding area because of the seepage of water from an irrigation project and the commingling of such water with other ground water.

Fred Woodland (T–128).—A bailee of property may properly file a claim against the United States under the Federal Tort Claims Act where it is shown that the property was damaged while in the bailee's possession and that the bailee is under a duty to reimburse the bailor for the amount of such damage.

E. I. Sheffield (T-145).—In a State where owners of uninclosed lands owe no greater duty to trespassing animals than to avoid injuring them willfully or recklessly, payment cannot properly be made under the Federal Tort Claims Act for the loss of dogs which allegedly ate poison from predator baits placed by employees of the Department on uninclosed public land.

LEGISLATION.—The Eighty-first Congress had, up to the end of the fiscal year, enacted 56 public laws of direct concern to the Department, representing 36 percent of the total of 154 public laws enacted during that period. The most significant of these statutes are listed below:

Public Law 11—Export Control Act of 1949.
Public Law 20—To authorize the transfer of Bushnell General Hospital, Utah, to the Secretary of the Interior.
Public Law 37—To grant the consent of the United States to the Upper Colorado River Basin Compact.
Public Law 47—To amend the Economic Cooperation Act of 1948.
Public Law 52—Alaska Housing Act.
Public Law 55—To amend title 28 of the United States Code in order to provide additional time for bringing suit against the United States in the case of certain tort claims.
Public Law 56—To approve repayment contracts negotiated with the Bitter Root irrigation district, the Shasta View irrigation district, the Okanogan irrigation district, the Willwood irrigation district, the Uncompahgre Valley Water Users' Association, and the Kittitas reclamation district.
Public Law 66—To grant the consent of Congress to the Gulf States Marine Fisheries Compact.
Public Law 72—To amend titles 18 and 28 of the United States Code.
Public Law 81—To amend the law relating to timber operations on the Menominee Indian Reservation in Wisconsin.
Public Law 82—To grant the consent of the United States to the Arkansas River Compact.
Public Law 87—To authorize the establishment of the St. Croix Island National Monument, in the State of Maine.
Public Law 91—To grant the consent of Congress to the Pecos River Compact.
Public Law 92—Travel Expense Act of 1949.
Public Law 102—To authorize the furnishing of water to the Yuma auxiliary project, Arizona, through the works of the Gila project.
Public Law 105—Public Buildings Act of 1949.
Public Law 109—Reorganization Act of 1949.
Public Law 115—Providing for the temporary deferment in certain unavoidable contingencies of annual assessment work on mining claims held by location in the United States, and enlarging the liability for damages caused to stock raising and other homesteads by mining activities.
Public Law 132—To authorize completion of construction and development of the Eden project, Wyoming.
Public Law 149—To incorporate the Virgin Islands Corporation.
Public Law 152—Federal Property and Administrative Services Act of 1949.

Litigation.—The case of *Frank Hynes* v. *Grimes Packing Co. et al.*, which had been pending in the courts for several years, was concluded by a decision of the Supreme Court (*a*) upholding the power of the Secretary of the Interior to include coastal waters, to a distance of 3,000 feet from the shore, within the boundaries of an Indian reservation in Alaska; and (*b*) holding that the Secretary of the Interior cannot properly apply the penalties provided for in the White Act (the statute under which the Secretary regulates the commercial fisheries of Alaska) to trespassers fishing without the consent of the Indians in an area of coastal waters included within the boundaries of an Indian reservation.

Statistical Summary.—The following is a statistical summary of the work accomplished by the Office of the Solicitor during the fiscal year which ended on June 30, 1949:

	Pending at beginning of year	Received during year	Disposed of during year	Pending at close of year
Cases for review	325	4, 913	4, 935	303
Miscellaneous correspondence	24	5, 339	5, 325	38
Appeals	504	322	719	107
Motions	18	91	107	2
Claims	16	91	93	14
Requests for legal opinions	18	79	77	20

The figures with respect to appeals to the Solicitor from the decisions of field attorneys in disposing of tort and irrigation claims have been included here in the item covering claims rather than in the item covering appeals.

In disposing of 107 motions for the reconsideration of decisions rendered on appeals, most of them were handled merely by writing letters to the parties rather than by preparing formal determinations on the motions.

Division of Territories and Island Possessions

James P. Davis, *Director*

IT IS in the American tradition of the dignity and worth of the individual that Americans have always felt the compelling moral necessity to help others help themselves. This attitude has been made articulate time and again in executive orders of the President and resolutions and acts of Congress pertaining to the territories and island possessions of the United States. This attitude has found expression internationally at the San Francisco conference, where the American delegation fought hard for recognition of this principle in the chapters of the charter of the United Nations dealing with non-self-governing and trust territories. A more recent example is the now famous "Point 4" outlined in President Truman's inaugural address this year.

We expect our territories to develop self-government as rapidly and completely as possible and look to the governors and legislatures of those areas to function much as they would in a State. Under our system it is neither desirable nor practicable for this Division to exercise actual control over territorial matters excepting perhaps in certain island areas where the peoples have yet to develop sufficient skills so as to be able to stand on their own feet.

In order to implement these goals, there are five major functions which this Division performs. First is the representation of Congress and the President in observing and reporting the political, social, and economic progress of the territorial areas under the laws enacted for their government. Second is the origination and implementation of Federal policy in the Territories through legislation; direct executive action through the governors, administrative action of other agencies through their field organizations, and public relations contacts. A third major function is the representation in Washington of the governors reporting through the Division to the President and working through the Division on congressional and departmental matters, as well as representation of individuals and organizations in the Territories in their relations with legislative and departmental offices here, and the Territories generally. Participation in foreign policy matters concerning or arising from our territorial interests is a fourth important function. These include United Nations questions and those of the various specialized agencies, as well as other international activities such as regional organizations like the Caribbean Commission, and also intragovernmental activities such as tariff and trade agreements affecting the Territories. Finally are the operating responsibilities in the Territories such as the Alaska Road Commission, The Alaska Railroad, the Puerto Rican Reconstruction Administration, and the Virgin Islands Corporation.

It is believed that outstanding progress has been made this year toward the achievement of the goal of helping our territorial and island neighbors help themselves. Some aspects of this progress are reported in the discussion of the several territorial areas.

PACIFIC ISLANDS

Progress was made during the year toward establishment of civilian administration in Guam, American Samoa, and the Trust Territory of the Pacific Islands and toward enactment by the Congress of organic legislation for these islands. These island areas are administered at present by the Navy Department under Executive orders which, in the case of Guam and American Samoa, were issued more than 50 years ago.

On May 14, 1949, the President requested the Secretary of the Interior to take the lead in cooperation with the Secretary of the Navy to develop realistic plans under which administrative responsibility for Guam would be transferred to the Department of the Interior within a year and that for American Samoa and the Trust Territory within 2 or 3 years. The two Departments submitted memoranda of understanding to the President providing in part that the transfer be effected on Guam on July 1, 1950, and in American Samoa and the Trust Territory on July 1, 1951. The plans also provide that civilian heads of these island governments should assume office well in advance of the transfer dates (i. e., on or about September 1, 1949, in Guam and July 1, 1950, in American Samoa and the Trust Territory) so that they might replace naval personnel with civilians and separate civil government activities from naval base activities by the transfer date.

The President's letter of May 14 and the transfer plans drawn up pursuant thereto is the result of 4 years of study among the interested departments and follows a recommendation made by the Secretaries of State, War, Navy, and Interior on June 18, 1947, that these islands be transferred to a civilian agency at the earliest practicable date.[1] The significance of these plans for extending civilian administration to Guam, American Samoa, and the Trust Territory is reflected in the following quotation from the President's letter:

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[1] On September 7, 1949, the President signed an Executive order approving the understanding reached between the Navy and Interior Departments as to the transfer of responsibility for the Government of Guam and setting the date of July 1, 1950, for the actual transfer of the Guam Government to the Secretary of the Interior.

> It is the announced aim of this Government to accord civil government and a full measure of civil rights to the inhabitants of its Pacific territories. The accomplishment of this objective will be furthered by the transfer of these territories to civilian administration and the enactment of organic legislation at the earliest practicable date.

The Department of the Interior submitted to the Eighty-first Congress draft organic acts for Guam (H. R. 4499) and American Samoa (H. R. 4500) which had been drawn up jointly with the Navy Department. (Similar organic acts were submitted to the Eightieth Congress, but no action was taken on them.) Hearings on the proposed organic acts were held on May 5, 1949, before the Territories Subcommittee of the House Public Lands Committee.[2] Draft organic legislation for the Trust Territory has been prepared by the State Department in collaboration with the Navy and Interior Departments and will be submitted to Congress at an early date. Enactment of organic legislation for each of these island areas is essential in order that the status and rights of the people and the structure and power of their governments may be established in law. The Congress acquired an obligation under the Treaty of Paris of 1898 to define the civil rights and political status of the Guamanians, an obligation which would be fulfilled if the Congress enacts the recommended organic act for Guam.

HAWAII

Protracted delay in the enactment of statehood legislation and a costly dock strike overshadowed the progress made in the Territory during the fiscal year.

Statehood Legislation

The President and the Secretary of the Interior have pressed strongly for enactment by the Congress of statehood legislation. The House Committee on Public Lands reported out favorably House bill 49 with only one dissenting voice on March 8, 1949. Its report, like those of other House and Senate committees in previous years, found Hawaii qualified in every respect for immediate statehood.

The House Committee on Rules failed to act on a rule to bring the measure before the House. There is abundant evidence that the measure would have been adopted by a large majority if it had been put to a vote. No action was taken on statehood legislation in the Senate.

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[2] The Public Lands Committee unanimously reported out House bill 4499 on October 3, 1949. A subcommittee visited American Samoa and the Trust Territory as well as Guam during November and December 1949.

The Territorial Legislature, impatient with Congressional delay, adopted a measure providing that the Governor shall call a constitutional convention between June 20 and November 17, 1949. There is well-established precedent for the Territory's initiative in proceeding without authorizing legislation to prepare a State constitution. Fifteen of the former twenty-nine Territories entered the Union in this way. The Territory's initiative should speed up Federal action to make Hawaii a State.

Unemployment and the Stevedoring Strike

The most crucial problem facing the Territory is the deterioration of labor-management relations as reflected in the strike of its longshoremen which began on May 1, 1949. The strike has aggravated an already serious problem of unemployment in the Territory.

The number of man-days lost due to labor-management disputes alone during the fiscal year 1949 rose to 192,816 as compared with 81,535 in 1948. Over 85,000 of those man-days lost resulted from the stevedores' strike. Since Hawaii is particularly dependent upon ocean transport, the entire economy has felt the impact of the water-front dispute. The immediate cause of the strike was a wage dispute between the stevedoring companies and the longshoremen, but the strike was complicated by an issue over the use of arbitration as a means of settlement, and by the relationship of the settlement in this case to labor-management relations in sugar, pineapple, and other industries in the Territory.

Unemployment has jumped from 3.6 percent of the labor force in June 1948 to 11.5 at the end of June 1949. This is attributable primarily to the reduction of military activities in the Islands. About 10 percent of the total unemployment is attributable to the waterfront tie-up. For many weeks, only foodstuffs and other essentials carried mainly by Navy relief ships were allowed to enter the Territory, and none of Hawaii's important sugar, pineapple, and other products could be shipped to mainland markets. Shortages of consumer goods have caused an increase in prices, a slowing down of business, and, in many cases, business failures.

Initial attempts by the national and territorial governments to mediate the strike having failed, the Governor, after consultations in Washington, called a special session of the Territorial legislature and obtained authority to take over dock operations. In the event of interference outside the Territory's jurisdiction with the flow of shipping into the Territory, further action by the Federal Government may be required. Immediate attention should be given by the Federal Government to the means of preventing recurrences of the shipping tie-ups which have caused great loss not only to Hawaii, but also to the other territories during the last few years.

Public revenues.—Territorial tax collections again set a new high in 1949, totaling $64,733,503, or some $3,300,000 over 1948's $61,433,503. This increase was due primarily to higher tax rates which became effective during fiscal year 1949 and to the fact that business volume had remained fairly steady up to the time of the water-front tie-up.

Housing, health, and education.—The housing situation is easing slightly in Honolulu and is somewhat more favorable elsewhere in the Islands. The Hawaiian Housing Authority increased its number of operating dwelling units to 4,671 as of June 30, 1949, and private enterprise was doing everything possible to provide housing at a price within reach of the family with an average income. However, Honolulu will not in the foreseeable future have adequate housing for lower-income-bracket families. Therefore, at least two and probably more extensions of Federal temporary housing will be requested.

The shortage of teachers eased considerably during the past year. A continuing shortage of classrooms is being met by a new bond issue voted by the legislature which will provide $7,650,500 for school construction.

The University of Hawaii has continued to contribute much to the economic and cultural life of not only the Hawaiian community, but also to other areas bordering on the Pacific. It has just graduated the largest class in its history, 537 students having received various degrees. In addition, scientists and other members of the faculty have played an important role in cooperation with Federal agencies in efforts to eradicate the Oriental fruitfly, and by contributing to valuable research and educational guidance in the Trust Territory. One of the most interesting events of the year was the sponsorship by the University of an East-West Philosophers' Conference at which intellectual leaders from many countries sought a common philosophical ground for understanding among the nations.

VIRGIN ISLANDS

The economy.—The development of tourism, the expansion and diversification of agriculture, and the inducement of new industry continue to be the paths of economic progress for the Virgin Islands. In all three directions there has been significant advancement this year.

The development of tourism, noted a year ago, has accelerated. Two small hotels have been opened in St. Thomas, adding another 86 rooms for the accommodation of visitors. Work in progress or plans prepared for sites already acquired should provide accommodations for at least 400 additional persons. This does not include the enlargement of the Government-owned Bluebeard Castle Hotel to which the new lessee is already legally committed. All hotels and guest houses were filled to capacity throughout the winter season and well on toward summer. Increasing awareness of the mild summer climate of the Virgin Islands, aided by wholesome publicity in mainland publications, leads to the anticipation of a much larger tourist season during 1949–50. Assurances have been obtained that tourist ships which by-passed the Virgin Islands last winter will call during the coming season. In St. Croix, the building or remodeling of structures for private winter residences is a notable development.

At the end of the year the rechartering of the Virgin Islands Company by act of Congress provided an instrumentality of great potential utility for the economic development of the islands. An authorized capitalization of about $9,000,000, will make possible a program of soil and water conservation, crop diversification, improved sugar cultivation and extraction, tourist promotion, and loans to small industries and business enterprises. However, the law restricts the amount of appropriations to the new corporation for fiscal year 1950 and 1951 to an amount sufficient only to carry on the present operation, so that developmental activities must necessarily be delayed.

A small group of fruit and vegetable growers, with the cooperation of the Virgin Islands Company, produced and shipped about 300,000 pounds of fresh vegetables, principally tomatoes, to the mainland for sale in the winter market. Benefiting by the experience of this first year of operation, these farmers are planning to continue and expand their enterprise next year.

In St. Thomas and St. John the hillsides are less favorable for agriculture than is the more level land of St. Croix. However, the successful resumption of banana culture on an experimental scale and the impounding of limited quantities of water to support a small amount of truck gardening during dry weather are noteworthy.

A basic reorganization of the program of governmental assistance to agriculture is in progress. For many years the Department of the Interior has administered this program. At the same time, the Virgin Islands have not received the benefit of extension, research, and other normal agricultural services of the National Government as administered through its Department of Agriculture for mainland communities. Upon recommendation of the Department of the Interior, a field study of this situation has been conducted in the Virgin Islands by the Department of Agriculture. As a result of this study the two Departments have recommended legislation to transfer all governmental agricultural activities in these islands to the Department of

Agriculture and to expand present limited activities so that the scope of the program will be comparable to that normally carried on by the Department of Agriculture on the mainland.

Although the Virgin Islands still have practically no industry, local legislation enacted in 1949 is designed both to encourage the establishment of new industries and to promote tourism. This legislation provides for designated tax exemptions and industrial subsidies for a period of 8 years to new industries which qualify with a minimum investment of $100,000. At the same time, the newly chartered Virgin Islands Corporation is legally empowered to make industrial loans, although there is no immediate prospect of capital for this purpose. These new incentives and opportunities for private enterprise should result in small-scale but significant industrialization in the years ahead.

Throughout the year employment levels have been higher than at any time since the termination of hostilities. A large increase in private construction and the continuation of the program of essential public works under Public Law 510, Seventy-eighth Congress, have been major contributing factors. Expanding tourism has also provided many new jobs. The demand for local needlework and other handicraft is exceeding current production. Only the continuing prostration of the rum industry and the decline of ships and shipping from countries unable to engage in dollar commerce have retarded the favorable trend in employment.

Finances of the local government.—The total budgeted expenditures of the Virgin Islands amounted to $1,708,580 as against $1,421,946 for the previous fiscal year. To meet these expenditures a total of $1,133,002 was raised from local taxation, and $520,200 contributed by Congress, leaving a deficit of approximately $53,000. This was due chiefly to the fact that actual collections made from trade taxes, customs dues, and harbor facilities were substantially less than the estimated yield from these sources. Reflected in this loss of revenue is the above-mentioned decline of commerce with foreign areas because of the dollar shortage.

In the municipality of St. Croix a total of $328,007 was raised through local taxation, as compared with $267,474 for the previous year. This was the second highest amount of revenue collected in one fiscal year in the recent history of St. Croix.

Governmental activities.—Vocational courses were added to the veterans' education program in the Virgin Islands. These vocational courses proved so popular that half the veterans who had enrolled in academic courses in the previous year transferred to the vocational division.

Enrollment in the public schools has increased 31.8 percent since 1938, and 10 percent this year. Due to the lack of adequate school buildings and equipment, the accommodation of this increasing enrollment becomes a greater problem each year and now has reached a critical stage.

A much-needed program of nurse training was initiated by the health department. Several nurses were sent for training to hospitals in the continental United States. Local public health services were expanded by the addition of a psychologist, a medical social worker, and nutritionist to the staff. The part-time services of a psychiatrist have also been secured. A pediatrician has been added to the medical staff. The demand for hospital services has increased about 40 percent since the war. The lack of adequate facilities creates an acute problem in both St. Thomas and St. Croix.

Throughout the island of St. Thomas conversion of the electrical system from direct to alternating current is substantially completed. However, funds are urgently needed to extend the system to include several rural districts including potential tourist hotel sites. In St. Croix the conversion from direct to alternating current is completed in Frederiksted and more than half completed in Christiansted.

Referendum.—In November 1948, for the first time in Virgin Islands history, a referendum was held. The purpose was to determine the views of the electorate on questions of basic importance in any revisions which Congress might make in the present Organic Act or Constitution of the Virgin Islands. This referendum revealed that an overwhelming majority of the voters were in favor of the Virgin Islands having direct representation in the Congress of the United States through a locally elected resident commissioner. They did not approve of the plan to unify the quasi-independent political districts of St. Thomas and St. Croix, nor were they favorably disposed toward the proposal for popular election of the Governor. However, it is significant to note that 40 percent of the voters who took part in the general elections did not cast referendum ballots.

Pending legislation.—House bill 2988, which is a bill to provide for a Resident Commissioner for the Virgin Islands, was submitted to the Eighty-first Congress, but at the close of the fiscal year action was still pending in the House and prospects for its passage this session seemed remote.

The need for expansion of electrical facilities has been noted above. In order to help the municipalities help themselves, House bill 4586 which would authorize the municipalities to incur bonded indebtedness also is before the Eighty-first Congress. Though it had passed the House on June 6, 1949, no vote had been taken on the measure in the Senate at the close of the year.

House bill 3105, which would extend the Vocational Act of 1946 to the Virgin Islands, is still pending in the House. Its companion bill, Senate bill 493, passed the Senate on April 11, 1949.

PUERTO RICO

The past year, Puerto Rico's fiftieth as part of the United States, witnessed one of the most important events in the history of the island. On November 2, 1948, Puerto Rico elected its own Governor, and with it achieved the highest degree of self-government enjoyed by any United States Territory or any other dependent area in the world. Except for the Presidential appointment of the auditor and supreme court justices, and the power of the United States Congress to annul any law passed by the Insular Legislation (something which has never yet been done), Puerto Rico has attained complete self-government. In a world where attention and interest is focused upon the problems of dependent areas Puerto Rico's election was highly significant, especially in Caribbean and Latin American countries. For the United States it was a demonstration of an avowed principle of promoting self-government everywhere; for Puerto Rico it was the fulfillment of one of her most cherished political aspirations.

The elected governor, Luis Munoz Marin, the candidate of the Popular Democratic Party received 392,386 votes, which was 61.2 percent of the total vote cast. His opponents, Dr. Francisco M. Susoni, candidate of the Independent Party, received 65,351 votes or about 10.2 percent; and Martin Travieso, supported by the Statehood Party, Socialists and Reformists, garnered 182,977 or 28.6 percent; 640,714 of the 871,000 eligible to participate in the election voted, or about 73 percent. Percentage-wise this is considerably better than any recent election for the United States as a whole or any State in the Union. The election was carried out quietly and without disturbances of any sort. The election served as an index of the current feeling of Puerto Ricans with respect to the problem of political status.

The overwhelming support given Munoz indicated a wide acceptance and support of his views, which are that Puerto Rico should first solve its economic and social problems, and express its attitude on permanent status later.

With the inauguration of Governor Munoz on January 2, 1949, the majority of Puerto Ricans were ready to forget colonialism and direct their energies toward the solution of the gigantic economic and social problems of the island. In spite of the significant advances made in industrial development, agricultural diversification, health, welfare, education and government, Puerto Rico continues to fight against terrific economic odds, chiefly the result of a population density of 640 per square mile, dependent primarily on agriculture with a meagre one-half acre of arable land per person, and a scarcity of minerals and other natural resources. If the Puerto Ricans are to enjoy a rising standard of living, increased productivity and economic expansion must more than match the steadily increasing population which doubled during the past 50 years.

During the year the Insular Legislature approved a budget of approximately $62,000,000, of which more than 40 percent is devoted to health, welfare, and education, representing a greater effort in these fields than that of any State in the Union. But in spite of this valiant effort there are only enough school buildings and teachers to handle slightly more than half of the children of school age. Public assistance grants to the aged, blind, dependent children, and physically handicapped are far below those of any State, and there remains an acute shortage of doctors, nurses, hospitals and clinics with which to deal with the health problems of the island. Nevertheless, each year progress is made in coping with these basic problems, and the past year was no exception. Plans were completed and construction started on two new hospitals and several health clinics. School facilities were increased, new and improved methods for teaching English were instituted, and welfare problems were handled with an increasing skill if not with additional funds.

On the economic front, marked progress was made in industrial development, agriculture, construction, transportation, tourism, electric power production, banking, and investments. Several new industrial plants were completed and started production, the sugar crop was the greatest in history, tobacco, pineapple, and coffee production increased, construction of one of the world's largest housing projects became a reality, the new 300-room Caribe-Hilton Hotel neared completion, construction on the Isla Verde International Airport made good progress, electric power consumption increased, while interest and activity on the part of industrialists and potential investors on the mainland proved to be greater than ever.

The Puerto Rico Industrial Development Co., created in 1942 by the insular legislature to carry out a program for the industrialization of the island, has assisted more than 40 new industries to become established on the island. During the past year several of these new plants were completed and started production, including that of the Crane China Co. at Vega Baga, which is reported to be one of the most modern pottery plants in the world. In order to speed industrial development of the island, the insular legislature enacted a law allowing tax exemption from property and income taxes to certain newly established industries. The law provides for total exemption until June 30, 1959, and partial exemption of 75, 50, and 25 percent, respectively, for the following 3 years. The executive council of Puerto Rico, which is charged with administering the law, announced that its purpose was not to encourage or approve the transfer of industries already established on the mainland, but rather to invite new capital investments so that Puerto Rico could share in the expanding economy of the United States.

Tourism continued to receive the attention of the Insular Government. During the year, Puerto Rico joined with other Caribbean areas to form the Caribbean Tourist Commission, whose task it is to encourage tourism throughout the Caribbean area generally. The new 300-room Caribe-Hilton Hotel announced December 9, 1949, as its opening date. (Eighty additional rooms are being added to the Condado Hotel, and the combined capacity of the Normandie Hotel and Escambron Beach Club is being expanded to 250 rooms.) The 10,000-ton passenger ship, S. S. *Puerto Rico*, the former Agwiliner *Borinquen*, purchased and reconditioned by the Bull Lines, was scheduled to sail from Brooklyn, August 18, 1949, on its maiden trip to San Juan, P. R., and Ciudad Trujillo, Dominican Republic. The remodeled ship, which has 199 outside staterooms, will leave regularly from Brooklyn for San Juan every other Thursday. With better hotel facilities and good transportation, San Juan is an ideal place for international conferences, and especially for meetings of representatives from Latin and South America. Efforts are already being made to schedule such conferences for San Juan.

Despite the beginnings of industrialization and crop diversification in Puerto Rico, sugar remains the island's biggest business. Sugar products accounted for $86,980,522 of the island's $134,457,197 shipments to the mainland during the 9 months, July 1948 to March 1949. When the cane-grinding season ended in Puerto Rico, the 1949 raw-sugar production stood at 1,277,491 short tons—a new record. Under the Sugar Act of 1948, Puerto Rico was given a basic marketing quota of 910,000 short tons, of which only 126,033 tons can be refined on the island; 100,000 tons was allotted to Puerto Rico for its own use. When it became certain that mainland beet-sugar producers would not fill their marketing quota, Puerto Rico was authorized to sell an additional 60,635 tons on the mainland. Of the remaining 206,856 marketless tons of sugar, about half may be labeled by the Secretary of Agriculture as normal carry-over against the possibility of a short crop in 1950. The balance must await further readjustments of the United States marketing or consumption quotas, or find overseas markets where prices are not so favorable.

At Puerto Nuevo, in suburban San Juan, what has been reported as the world's largest housing project grew rapidly. Construction began in May 1948, and by mid-September families were occupying 900 mass-produced, reinforced concrete dwellings. During the year as many as 50 houses in 1 day were completed. The cost of the one story (three to five rooms) house is $3,095. Pay-as-you-go installments are approximately $25 monthly, and for veterans down payments are not required. Each house has running water, electricity, and plumbing, and the development has concrete-paved streets and broad cement walks. Originally planned for 5,136 low-cost homes, the project may be extended to include 7,000 to 10,000 homes before it is completed. The San Juan Housing Authority completed arrangements for a $2,000,000 bond issue, part of which will finance completion of a San Juan housing project called Puerto de Tierra, where the first 232 units are already under construction.

In April, Governor Munoz proposed a "Little Hoover Commission" to overhaul the Insular Government. The commission was patterned along the lines of the Hoover Commission and has started its studies. On its staff are a number of keymen from the Hoover Commission.

When President Truman announced the "point 4" program, Puerto Rico immediately responded with an offer to contribute. Puerto Rico, an underdeveloped area itself, has been suffering acutely from the same difficulties as other underdeveloped areas in South America, Africa, and Asia. But it has already launched modest efforts to cope with these problems. The low-financed, pay-as-you-go type Puerto Rican approach is more within reach of poor countries than the mainland large-scale methods of doing things. Spanish-speaking students and trainees would have no language handicap to overcome, and their own technicians have a language advantage in going to Spanish-speaking countries. The island stands ready to give scholarships for the training of certain types of technicians for underdeveloped countries. The School of Tropical Medicine, vocational and industrial art schools have excellent progress ratings, and an international reputation. Puerto Rico has already offered 30 scholarships to its industrial art school through the Caribbean Commission, and the island is rapidly becoming recognized as a natural training ground for students and technical trainees from Caribbean and Latin-American countries. In-service training programs in a score of Insular Government agencies are being planned in detail. Governor Munoz and his people are genuinely interested and anxious to participate in the "point 4" program.

Puerto Rico's purchases from business concerns in continental United States reached an all-time peak in 1948, totaling $338,000,000, and 9.5 percent higher than in 1947. It is estimated that this amount supports approximately 200,000 jobs on the mainland. The value of the island's purchases from the States in 1948 was 83 percent greater than the amount received from the sale of Puerto Rican goods to mainland.

At the close of the fiscal year, the relationship between Puerto Ricans and their fellow citizens on the mainland had reached an all-time high in mutual understanding. With blueprinted remedial plans, Puerto Ricans were facing the task of developing their economy with courage, initiative, and real hope. In the words of Governor Munoz, Puerto Rico had abandoned what might be called "operation lament" and was in the midst of "operation bootstrap."

ALASKA

The fiscal year ended June 30, 1949, saw greater progress in and for Alaska than has been the case for many years. Shortly before the beginning of this period, the President sent to the Congress a special message dealing solely with the needs of the Territory and plans for its development. The principal recommendations contained in his message included: (*a*) Statehood for Alaska; (*b*) improvement of the transportation system; (*c*) provision for the construction of housing and community facilities; (*d*) enactment of legislation aimed at the settlement of Alaskan native claims; and (*e*) revision of land laws to facilitate settlement.

He stressed the need for legislation to implement the Administration's program for increasing the population of the Territory and for building a sound economic structure. This is in line with the findings of the Inter-Agency Committee on the Development of Alaska as outlined in its report submitted in 1948.

Perhaps the most significant and far-reaching development with respect to Alaska during the year 1949 was the enactment by the Nineteenth Legislative Assembly of the Territory of much basic and badly needed legislation which, as stated by Governor Gruening, will result in "putting Alaska's house in order." In speaking of its record of substantial and sound legislative achievement, Senator Andrew Nerland said: "The Nineteenth Legislative Assembly did what 18 previous legislatures were unable to do."

The tax structure was completely overhauled and a number of laws were adopted that are believed necessary in the structure of the new State of Alaska when statehood is granted. Among the revenue measures set up are a general property tax, a graduated income tax, and a comprehensive system of business licenses and fees. In recognition of the need for additional school facilities $2,250,000 was appropriated for new buildings and school facilities, and the proceeds of the tobacco tax were earmarked for school construction and repair. Salaries of teachers were increased $300 per annum. Welfare assistance was liberalized and the program of loan assistance to veterans was revitalized. An Alaska National Guard was set up, as were Territorial departments of fisheries and aviation. A statehood commission has been established to work for statehood and to prepare for a constitutional convention when enabling legislation has been passed by the Congress. Construction of a new Territorial building was authorized and several measures extending a greater measure of home rule to municipalities were enacted.

The foregoing deals with legislation enacted by the Territory itself; in addition, much progress is being made on Alaska legislation by the Eighty-first Congress. Legislation that would open the way for statehood for Alaska is pending. A favorable report on the enabling bill has been filed by the Committee on Public Lands of the House of Representatives.

Improvement of living conditions is expected to result from the enactment of special legislation designed to relieve the very bad housing situation in Alaska. This law (Public Law 52, 81st Cong., 1st sess.) acts to revise Federal Housing Administration regulations so that the FHA program will be better adapted to local conditions. It also authorizes the appropriation of not to exceed $15,000,000 for use of the Alaska Housing Authority in construction of dwellings for rental purposes or in making loans to supplement the regular FHA program. A public-works law for Alaska authorizing the appropriation of up to $70,000,000 to be used for construction of community facilities has been enacted by the Eighty-first Congress. This legislation would make funds available to local communities or organizations on a matching basis.

The license tax passed by the Territorial Legislature could not become effective until the Congress amended the Federal law. This Congress has now done, so that the Territorial Act will become effective January 1, 1950.

Further attention should be given to the question of aboriginal rights in Alaska. There has been no definite action taken to settle the issue since 1947, when the question was met in part under the Tongass Timber Act (Public Law 385, 80th Cong., 1st sess.). There is not yet unanimity of opinion on the method of handling this problem and further investigation and study of the native rights undoubtedly will be required.

Through a slight modification of the land laws affecting Alaska, the Congress has set up a procedure through which up to 160 acres of public land may be sold to individuals or organizations. Land acquired under this law must be used for commercial purposes, such as operation of a business or small industry. This action may be considered a first step in opening the way for more widespread private ownership of land in Alaska where over 95 percent of the land area is still held by the Federal Government.

A contract has been entered into between the United States Forest Service and private interests covering the cutting of timber in the Tongass National Forest and the construction of a pulp mill near Ketchikan. It is anticipated that actual work may begin on the project within the next year. The pulp and paper mills would bring the Territory a much needed pay roll and its first real year-round industry. Further investigation of the water power potential in Alaska has been undertaken by the Bureau of Reclamation. On the basis of the first report submitted by the Bureau there is now pending before the Congress legislation that would authorize construction of the Lake Eklutna project. This project would relieve the critical power shortage that now exists in the Anchorage and Matanuska Valley area. Low cost power is considered essential to industrial development of the Territory.

Other recent developments of importance to Alaska and its people include appropriation of $6,000,000 for construction of a tuberculosis hospital for natives and over $1,500,000 for special public-health studies and programs. These funds were made available after a survey of Alaska's medical and health needs had been completed by a team made up of representatives from the American Medical Association and the United States Public Health Service. A separate Alaska district with headquarters at Juneau was reestablished by the United States Coast Guard. The Territory has been zoned for parcel post purposes for the first time, which should enable local businessmen to compete with outside firms more advantageously.

Shipping between the States and Alaska was tied up by a coastwise labor dispute again in the fall of 1948. This time, however, the interruption was not so severe as during the previous years. This tie-up was of shorter duration than in 1946 and an emergency barge service was initiated by The Alaska Railroad to relieve the strain on local supplies of necessities. Air carriers were also authorized to expand their services during the emergency and there was increased use of Canadian vessels and overland transportation via the Alaska Highway. Regular steamship service to the Rail-belt area has been augmented by the Coastwise Steamship Co. operating from California ports, Portland and Seattle to Seward and Whittier. Recent action of the Congress has temporarily liberalized the shipping laws in such a way that Canadian vessels may be used for limited freight and passenger service between points in southeastern Alaska.

For the first time, the isolated Aleutian Island area is now receiving regularly scheduled boat service as a result of the Post Office Department entering into a contract with a local transportation operator for the carrying of the mail. This service will stimulate the livestock industry and the fishing industry in the area, and provide transportation facilities to the residents of numerous small communities, especially those now serving the air fields on the international airways.

Rehabilitation of The Alaska Railroad has progressed very well.

During the 1949 fiscal year there was available $17,000,000, plus contract authorization of $12,000,000, for carrying on the program.

The international airports at Anchorage and Fairbanks are under construction. Upon completion these airfields will be a major step forward in aviation which plays such a significant role in the Territory. Funds now available through the Civil Aeronautics Administration are expected to result in construction of several community airports at points in interior Alaska.

Road construction by both the Alaska Road Commission and the Public Roads Administration is moving forward at an accelerated rate. New roads being pushed rapidly toward completion include the 125 miles from Kenai Lake to Homer and the section of 115 miles from Tok Junction on the Alaska Highway to Eagle on the Yukon River. Other major projects now underway are the Turnagain Arm Road that will link the Kenai Peninsula with the principal highways to the north and hard-surfacing of the Glenn, Richardson, and Alaska Highways, as well as the Tok and Haines Cut-off roads.

The most serious problem now facing the Territorial Government is a shortage of ready funds with which to meet current obligations. This difficulty is the direct result of the lag between enactment of tax statutes and their effective dates so far as actual collections are concerned. It is expected that the collection rate will step up rapidly after January 1, 1950, and that the pressure on the Treasury will then be relieved. In the meantime, Territorial officials are endeavoring to arrange a short-term loan to cover accrued obligations.

An Alaska field office has been established by the Department with a director in charge who is stationed at Juneau. Under the general direction of this office, the Alaska Field Committee, composed of representatives of the various agencies of the Department in Alaska, has been organized and is developing a coordinated program of development for the Territory. This committee has already submitted its first formal report covering a projected plan of action for the Department's agencies in Alaska during the 6-year period of 1950–55.

Although almost 7,500 vehicles crossed the Alaska border on the Alaska Highway during 1948, it may still be said that the tourist potential is almost wholly undeveloped. The great bulk of the people arriving are either new settlers or workers looking for a job. Facilities along the highways are not at all adequate to accommodate any sizable number of tourists. It seems likely that the lead in developing such accommodations may have to be taken by the Government.

Limited unemployment was reported in Alaska during the early summer of 1949. Despite the extensive outlay on Federal projects such as rehabilitation of the railroad and construction of roads and military facilities, the influx of new workers and the tightening of operating practices by the contractors combined to make for an oversupply of common labor. Further falling off of the salmon catch in some districts and continuing lethargy in the gold-mining industry are other factors contributing to the deterioration of the employment situation.

Several measures having a direct relationship to agriculture in the Territory have been enacted by the Congress in recent months. The full benefits of the acts under which funds are allotted to the several States and Territories for carrying on extension service and experiment station work have been extended to Alaska. In taking this action the Congress has made available the means for providing a more comprehensive program of education among farmers and wider experimentation in Alaskan agriculture. There has also been enacted a law through which the Farmers Home Administration of the United States Department of Agriculture is authorized to make loans on homestead lands before patent is acquired by the settler. Loans of this type have been needed for some time to stimulate farm development. Payments for land clearing with a maximum allowance of $40 per acre are available this year under the Agricultural Conservation Program, another United States Department of Agriculture function. Early indications point to a potential compliance that will soon exhaust the allotment set up for Alaska. This program is of great value to the settlers and should be continued on a larger scale. It is now estimated that there are about 12,000 acres of croplands in the Territory and that total annual agricultural production is valued at some $2,500,000.

Puerto Rico Reconstruction Administration

James P. Davis, *Administrator*

* * *

OPERATIONS that differ little in essentials from those of the previous years were financed with allotments out of the Puerto Rico revolving fund for projects approved by the President, as follows:

Housing management	$273, 104
Management and operation of federally owned lands at Lafayette	7, 226
Operation and maintenance, Castaner project	61, 305
Servicing of cooperatives	14, 944
Repairs and replacements, construction of farmers' houses and latrines	201, 685
General administration	228, 736
Total	787, 000

The loans and notes receivable for rural and urban housing units are being liquidated as rapidly as possible by this Administration, and both individual rural and urban housing units are being sold to the present occupants.

Receipts from the housing units and sale of lots at the Eleanor Roosevelt and Juan Morell Campos developments during the fiscal year 1949 amounted to $447,620.76, and exceeded maintenance and operation expenses by $174,516.76. As of June 30 a total of 347 urban and 6,077 rural month-to-month rental agreements had been converted into long-term leases with option to purchase, and 826 units had been conveyed and title vested in rural and urban tenants, while under the liquidation program, 2,035 urban and rural units were sold under the deed-mortgage plan during the year.

Central Service Farms, as in previous years but on a greatly reduced basis, continued to assist needy resettlers in the raising, harvesting, and marketing of subsistence crops by furnishing seeds and fertilizers. Meanwhile, essential projects are being continued for the fiscal year 1950 with an allotment of $735,000 from a revolving fund derived from PRRA operations. The net available balance in the revolving fund on June 30, 1949, was $3,029,070.

Division of Geography

Meredith F. Burrill, *Director*

THE function of the Division of Geography is to discharge the duties of the Secretary of the Interior under the act of July 25, 1947. This act established the Board on Geographic Names which, conjointly with the Secretary, provides for uniformity of geographic nomenclature and orthography throughout the Federal Government. The Division performs research and other staff functions leading to the standardization of geographic names by the Board and the Secretary as required under the act.

In 1949 the Division performed basic geographic and linguistic research on the nomenclature of over 40 countries or comparable area; drafted policies and procedures for the standardization of names in these areas; investigated 1,500 individual names for decision by the Board; did research on over 75,000 standard names; compiled gazetteers containing nearly 100,000 standard names; edited over 160,000 names on maps and in textual materials for correctness of spelling and application; and answered 6,500 miscellaneous place name inquiries.

Most of the work pertained to foreign areas and was used by Federal agencies producing maps and reports. Little was done to meet domestic name requirements because of dependence on working funds.

United States Board on Geographic Names

The Board on Geographic Names is an organization composed of representatives of 11 Federal departments and agencies. Its purpose is to provide for the standardization of geographic nomenclature throughout the Federal Government. J. B. Hutt, representing the Department of the Navy, was Chairman during 1949.

The Board and its committees held frequent meetings during the year to take action on nomenclature policies and procedures, to standardize names, and to act upon other matters within its jurisdiction. Its activities included the review of the policies and decisions of predecessor Boards as well as the determination of new policies and names not previously standardized.

Much of the Board's work pertained to nomenclature in Europe and Asia, but individual names were standardized by decision for the United States, Alaska, and Antarctica. Plans were made for intensive work on Antarctic and Arabic names during 1950.

Budget and Administrative Management

Vernon D. Northrop, *Director*

THE Division of Budget and Administrative Management is responsible for general direction and supervision over the financial and administrative planning functions of the Department. It also conducts investigations of alleged irregularities. The organization of the Division consists of an Office of the Director and four branches covering Budget, Finance, Organization and Methods, and Investigations.

Appropriations for the Department for the fiscal year 1949 amounted to $463,900,000, an increase of $199,000,000 over the 1948 appropriations. Of the total appropriated, $56,100,000 was obtained through supplemental appropriation acts. The Budget Branch develops general budgetary policies, devises methods and standards to guide the original preparation of budget proposals within the bureaus; and analyzes the proposals in relation to the Department's budget program. The Branch also assists in the presentation of the Department's estimated budget requirements to the Bureau of the Budget and the Congress.

In reporting on the Interior Department appropriation bill for 1950, the Interior Subcommittee of the House Appropriations Committee recommended that consideration be given to the presentation of the Department's 1951 estimates on a uniform and simplified basis. In line with this desire of Congress, the budget staff has developed a program for the preparation of a new pattern of appropriation structure which can be used as the basis for presentation of the 1951 budget estimates. This program should result in substantial progress toward achieving the objective of a simplified and uniform budget presentation for the Department.

The Branch of Finance has participated actively in the joint program of the Bureau of the Budget, Treasury Department, and the General Accounting Office for improving accounting in the Federal Government. Accounting and fiscal problems involving the Bureau of Reclamation and the Bureau of Land Management have received special consideration. A comprehensive study of accounting and financial reporting procedures in the Bureau of Reclamation, started during the fiscal year 1948, has been carried out by the staffs of the Bureau and the Department working in cooperation with the Bureau of the Budget, the Treasury Department, and the General Accounting Office. The General Accounting Office has participated with the Division in a study of the collection procedures in the Bureau of Land Management. A comprehensive study of the accounting and financial reporting procedures was initiated during the year in the Bureau of Indian Affairs under the joint auspices of the Department and the General Accounting Office. The Branch also has directed attention to the standardizing of certain special accounting forms for use throughout the Department.

During the past fiscal year, the Organization and Methods Branch served as the liaison office with the Commission on Organization of the Executive Branch of the Government. In this capacity, the Division directed the work of preparing the comments and recommendations of the Department in regard to the four Commission reports dealing with management of the executive branch. It also assisted in the preparation of comments and recommendations of the Department on the Commission's report concerning the Department of the Interior.

Management planning assistance is rendered to the bureaus and offices of the Department by the Branch. Particularly, attention has been devoted to the organizational problems of the Bureau of Indian Affairs, the Bureau of Land Management, the Bureau of Mines, and the Division of Administrative Services.

The Branch of Investigations conducts investigations of complaints of irregularities in the performance of official duties by employees of the Department; investigates the records of guardians of incompetent Indians in cases where information is received indicating the guardians are not properly administering and accounting for the estates of their wards, and investigates other miscellaneous matters to obtain information on which to base administrative decisions. Reports of investigations indicating possible criminal offenses have been referred to the Department of Justice for decision as to the institution of criminal proceedings.

Division of Personnel Supervision and Management

Mrs. J. Atwood Maulding, *Director*

DURING the fiscal year 1949 the employment scene shifted considerably. The number of applicants interviewed in the central personnel office for the last month of the fiscal year was double that of a year ago. The supply of engineers, engineering aids, stenographers, and typists has overtaken the demand, but the supply of doctors, nurses, and teachers falls far short of the present needs. Positive recruiting by the bureaus and offices at colleges, universities, and other sources of supply, and the holding of examinations by departmental committees and boards of examiners have been effective, but appropriation limitations have restricted these activities. The Bureau of Reclamation particularly has been able to do considerable recruiting and examining and has filled its engineering and engineering aid needs in this manner.

With the completion of the delegation of appointing authority to the bureaus came the responsibility of seeing that established policies, standards, and procedures were complied with, as well as serving in an advisory capacity to those in charge of personnel. The Branch of Inspection which was set up in the central office the previous year is playing an increasingly important part in this connection.

The value of supervisory training is being felt more and more throughout the Department, and supervisors' forums were conducted this year. As a step in building the Department's reserves of supervisory and administrative talent, a group of field career employees of outstanding ability, nominated by the bureaus and screened by a departmental committee, has been selected and will be given assignments and management guidance which will broaden their scope of usefulness. Similar assignments are being given to several eligibles selected from the Civil Service Commission's junior management assistant register which the Division helped to set up by conducting oral interviews of applicants and rating vouchers submitted in their behalf. This group of 17 employees will strengthen the available supply of personnel for the Department's future administrative positions, and the continuance of such a program will assure a ready reservoir of exceptionally qualified employees.

In April a week-long conference of the Department's personnel people was held in Washington for the purpose of reviewing the personnel policies of the Department in the light of its present needs. In addition to the secretariat and the bureau heads, several specialists in various phases of personnel administration participated. Responsibility of the personnel offices, decentralization of personnel authorities, human relations, the Hoover Commission report on personnel mangement, public relations, program thinking, employment and training, Federal pay administration, and classification principles were among the subjects covered. Twenty-nine resolutions for the betterment of personnel administration in the Department emanated from the conference and are now being studied with a view of putting them into effect.

Under the auspices of the Division's Section of Training a committee of representatives of all bureaus and offices completed the revision of the Department's 10-year-old Stenographer's Handbook, and produced the new Correspondence and Style Handbook. It is designed to guide and assist those who handle the Department's correspondence and official documents.

The organizational changes which occurred in the bureaus and offices during the year placed a heavy load on classification. While certain positions were abolished, new positions had to be established and others changed. This required the preparation of new allocations and revised job descriptions. Work has been completed on a number of classification standards and specifications that materially affect positions and employees of the Department. Certain positions in the duplicating shops were changed from the classified service to ungraded positions to conform with new regulations of the Civil Service Commission.

Wages for the ungraded positions in the Department have been adjusted periodically in line with the trends in particular industries at various locations. In this connection several public hearings were held.

A "collective bargaining" agreement between the Department and a group of its employees was drawn up to affect the employees at Coulee Dam. Although the agreement has not yet been completely processed it represents the initial action in the Department pursuant to the General Labor Relations Policy Statement issued by the Secretary in January 1948. This is an extension of the type of agreement which has been in effect heretofore on the Alaska Railroad and at Bonneville Power Administration.

The Division of Personnel Supervision and Management issued the Interior Department Supplement to the Federal Personnel Manual this year. The supplement explains Department personnel policy and procedure and supersedes all personnel regulations issued heretofore. It will serve a very useful purpose under decentralization of appointing authority as it, together with the Federal Personnel Manual, contains the basic regulations and policy for carrying out the delegated personnel responsibilities.

There were 262 retirements during the year, of which 53 were for age, 139 optional, and 70 for disability.

At the close of the fiscal year the total number of compensated employees was 57,801, of which 4,361 were in the Washington, D. C., metropolitan area and 53,440 located in the field. Of the total number, 37,407 are classified by grade under the Classification Act, 17,065 under wage-board procedure, and 3,329 employees of various classes and ungraded. Veterans in the Department continue to increase, now numbering 22,889. The number of women is 10,745.

During the year the Director of Personnel served as a member of the Federal Personnel Council and chairman of its legislative committee, as a member of the Department Board of Awards, and as Secretary to the Department Loyalty Board.

Interior Department Museum

H. L. Raul, *Museum Curator*

* * *

DURING the fiscal year, part of which merged into the centennial year of the Department of the Interior, the museum continued to visualize to the public the history, aims, and current activities of the Department. On March 3, 1949, marking the one-hundredth anniversary of the date of establishing the Department, a special reception was held in the museum by the Secretary of the Interior. More than 1,000 guests were present, including Members of Congress and other Government officials, Department personnel, and many prominent conservationists and representatives of the press, radio, and motion-picture industry. Special exhibits were displayed throughout the museum featuring the growth of the Department and its services to the Nation. The presence of Mr. John K. M. Ewing, grandson of Thomas Ewing, the first Secretary of the Interior, added an effective note in linking past and present.

Attendance and foreign visitors.—Museum visitors during the past year numbered approximately 34,000 persons. Visitors were recorded on the visitors' register from all of the States in the Union, and from Alaska, Hawaii, and Puerto Rico. Throughout the year, foreign visitors registered from Australia, Bolivia, Brazil, Canada, Chile, China, Colombia, Cuba, Czechoslovakia, Denmark, Dutch East Indies, Ecuador, Egypt, England, Finland, France, French Morocco, Germany, Greece, Haiti, India, Japan, Mexico, Netherlands, Nicaragua, Norway, Pakistan, Peru, Republic of the Philippines, Siam, Sweden, Turkey, Union of South Africa, Uruguay, and Venezuela.

Beginning April 18, the regular museum hours were revised forward to 9 a. m. to 5:30 p. m., a change affording added convenience to the public.

Special exhibits.—To continue throughout the centennial year, bureau special exhibits are held monthly. Thus far the series has included the following, with others planned and in preparation:

March: Office of the Secretary—facsimile reproduction of the original act of March 3, 1849 (9 Stat. 395), establishing the Department.

April: Bureau of Mines—illuminated exhibit, Oil Shale Demonstration Plant Project.

May: Fish and Wildlife Service—large-scale model of Hell's Gate Fishways on the Fraser River, British Columbia, constructed by United States and Canada.

June: Geological Survey—large-scale model showing method of trimetrogon surveying of public lands, the latest development in making surveys by airplane.

Collaboration with bureaus.—Maintaining contact with the bureaus, numerous case revisions have been made.

The museum prepared a special traveling exhibit consisting of 12 display panels showing the training courses and methods of the Division of Personnel Supervision and Management. This exhibit was displayed at the Government Training Officers Conference held in Washington.

Cooperation with other agencies.—Services in assistance and consultation in display techniques were rendered, upon request, to a number of agencies, including American University, George Washington University, Harvard University, Johns Hopkins University, Oklahoma Agricultural and Mechanical College, University of Maryland, United States Army, United States Navy, Department of Justice, Department of State, United States Public Health Service, National Museum, Virginia State Department of Highways, and the Argentine Museum of Natural History.

Assistance has been received from the United States Navy in diorama repair and from the United States Army Signal Corps which released to the museum typical signal corps equipment, such as was used by the American Indian scouts in World War II.

School classes and organization groups.—Numerous school and college classes visited the museum in connection with their conservation and history courses. Many guided museum tours were given. Upon special request, the museum was held open for evening groups such as the Farmers Union of North Dakota, and the Camp Fire Girls conservation classes.

A special Saturday morning group of German professional women, selected by the United States Military Government to train for German leadership, expressed keen interest throughout their museum tour; likewise a special group of men teachers and specialists in education, similarly sent to the United States to study the American way of life, indicated much satisfaction derived from the exhibits.

A reception was given in the museum by the Secretary of the Interior on the evening of November 17, to welcome 109 delegates from 50 nations, in connection with the Washington Conference of the United Nations Food and Agricultural Organization. Special exhibits were displayed in the museum.

Publicity.—Inquiries were handled daily at the information desk and special services rendered whenever requested. The museum has received favorable notices in several Washington guidebooks, and in newspaper, magazine, and radio publicity.

Suggestions Committee

ESTABLISHED by order of the Secretary of the Interior on December 1, 1942, the suggestions committee has completed its seventh year of operation. Created for the purpose of inviting suggestions from Department employees for improved ways of handling departmental business, the committee has processed 5,730 suggestions resulting in 997 being awarded and estimated savings of $4,608,064. Awards ranging from $10 to $1,000 have been made, eight of them for $1,000. Suggestions have been awarded for the elimination of unnecessary practices or procedures, expediting work through a more effective application of present practices, methods and procedures, improving the quality of work, for inventions which would simplify, make unnecessary, or improve some mechanical processes now being followed, and for other suggestions covering all of the operations of the Department.

In April 1948, the committee was expanded to embrace the honor awards system which provides for the recognition of exceptional, meritorious, and commendable service upon the part of its employees. These awards consist of a citation outlining the reasons for which the award is made, accompanied by a certificate and a gold, silver, or bronze medal.

A summary of the activities of the suggestions committee for the 1949 fiscal year is as follows:

Number of suggestions received: 694.
Number awarded: 110.
Cash awards: $6,665.
Savings: $238,164.

Honor awards granted:
  Distinguished service: 52.
  Meritorious service: 58.
  Commendable: 414.

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the Secretary of the
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Oscar L. Chapman

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DEPARTMENT OF THE INTERIOR
OSCAR L. CHAPMAN, *Secretary*

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Resources for Our Expanding Economy

Oscar L. Chapman, *Secretary of the Interior*

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PRODUCTION GROWS WITH THE PEOPLE

IT IS FORTUNATE that when the fighting broke out in Korea on June 25, 1950, the people of the United States found themselves advancing steadily along the road to increased production.

The World War II peak output of military and civilian goods and services, once viewed by some observers as an emergency economic phenomenon, has been followed by record-breaking production for peacetime living. Since the end of hostilities in 1945, the production spiral has continued swiftly upward. The period has been marked by an unequaled advance in the standard of living of the American people. In addition, our citizens have extended substantial and effective assistance to the people of other free nations who are striving to reestablish sound economic foundations.

Convincing and satisfying evidence of this achievement is reflected in our consumer goods—our houses and household conveniences, our food, our cars, our clothes—as well as in the great expansion of our industrial plant. In the year ending June 30, 1950, our national output exceeded 260 billion dollars and we achieved a national income of close to 220 billion dollars. The number of people working reached 61.5 million. The pay of working men and women increased substantially. While farm income was slightly down from the peak war years, it continued to reflect a high standard of prosperity.

The steel industry, a generally accepted gage of the Nation's economic well-being, was operating close to 100 percent of capacity in June 1950. During the year we built about 838,000 single family houses and 216,000 multifamily dwelling units—far exceeding construction records for any previous period.

In the attainment of this gigantic production, never remotely approached anywhere in the world, we have been expanding not only our industrial plant but our civic horizons. Our determination to establish and secure more abundant living for ourselves and our children is clearly reflected in the plans currently being made to push production still higher in the next 10 years.

We are coming rapidly to realize that we need accept no narrow limits for our production goals. Along with this conclusion is the growing conviction that the products of an expanding economy, fashioned by the collective skills of the people from their own natural resources, should be used for enriching the living of the people. We are, in fact, growing in our awareness that our greatest resource as a Nation is the people themselves and that whatever we do with our material resources must be done for the people's welfare.

Spurred by this growing awareness, we need to take stock of the economic factors that underlie the advances we have made. It is vital that we should recognize both our weaknesses and our strengths if we are to succeed in directing the Nation toward the bold production goals we have established. It is today of exceptional importance that there be a full understanding of our capacities for maintaining abundance in peacetime and for meeting the emergency requirements of defense.

The growth in America's economic strength could not have come about without intensive utilization of all our country's resources—our minerals, soils, forests—our lands and waters. These resources have, up to now, met our major needs in peace and war. Nature has supported us almost without stint as we became the greatest industrial Nation in the world, the producers of almost half the world's industrial goods. These natural resources, however, are not inexhaustible and the step-up of our industrial production has meant their systematic depletion at an increasingly rapid rate.

We need, therefore, to reappraise our resources of minerals, power, water, and land. These resources must provide the foundation for the dramatic program of economic expansion which has been called for by the President. If we are to achieve the goal of lifting our annual output of goods to the new levels demanded by our defense program and the needs of our people, we must plan our efforts carefully, in order to stretch our limited resources as far as possible.

There is abundant evidence that this appraisal of our natural resources is going forward with increased understanding by the American people of the problems they may have to face before our goals for economic expansion can reach full fruition. As the year covered by this report ended, our activities in all areas of natural resource development were being rapidly mobilized to meet the needs of our expanding economy. While these activities were directed toward harnessing our resources for maximum service to the people in peace, their bearing upon America's security in war was also a foremost consideration.

Americans generally understand the historic importance of our natural resources in building this country's strength. As the Nation grew, we moved into the vast interior of the continent, claiming large tracts of public land, cutting magnificent stands of timber, planting the rich soil, and extracting the plentiful minerals from the earth. With the advent of the new industrial age and the internal combustion engine, we pumped deeply into our oil reserves, issued huge demands on industry for products of steel and aluminum, plowed ever more intensively the lands of our plains, and built new communities to care for our fast-growing population.

We were both slow and reluctant to recognize that the demands we were making on our resources were stupendous, even when considered in relation to the abundance provided by nature. We are finally coming to appreciate, however, that our resources are limited, and that the bottom of the barrel has nearly been reached in some instances.

We have too often wasted our soil by mining it without rebuilding its fertility, or by leaving it uncovered to be ravaged by wind and rain. The loss of enough soil each year to cover 2½ million acres to a depth of 7 inches is evidence of our failure to protect the basic source of our food and fibers.

We have wasted our forests by failing to replant trees when vast areas were depleted by careless cutting, or by permitting fire and disease to wreak unchecked destruction.

We are beginning to realize the extent of the drain on minerals created by our industrial usages throughout the years. Extracted minerals are an irreplaceable resource, and it is not surprising that we should begin to experience mineral shortages as the price we are forced to pay for our past industrial achievements. Our rich iron ore is seriously depleted, and careful study and bold action are needed if new sources are to be made available for continued and expanded steel production. It is possible that the consumption of petroleum in the next decade will exceed domestic discoveries. And there are some strategic minerals which we must now obtain from other nations if our economic expansion goals are to be attained.

Our water resources are a matter of considerable concern in some areas. We have paid scant attention to water because of its great abundance. We are now aware that we have too long permitted stream pollution, and the wasted flow of waters that might be stored in reservoirs for man's use. Many communities are now facing tremendous problems because they failed to plan for adequate local water supplies.

A realistic appraisal of our resources, in relation to the growing needs of a dynamic industrial economy, must lead to a rejection both of continued waste and the kind of conservation that consists of unsound and unnecessary hoarding. Our resources can be of value to us only if they are used. But we can never again afford to gorge and waste. Our remaining resources can serve most of our needs adequately, but only if we direct their devlopment and exploitation wisely.

Our program of conservation and mobilization of national resources to provide the underpinnings for continued economic expansion will demand intelligent management in a score of vital areas.

Management of our soil will entail the employment of the most modern scientific techniques in soil enrichment, protection, rebuilding, and use.

Management of our mineral resources calls for continuous geological surveys for new deposits, experimentation for more economical usage, the development of substitutes and synthetics, the devising of techniques for utilizing low-grade deposits, and continuous efforts to make foreign ores accessible.

Management of our water resources must be directed toward securing accurate and extensive knowledge of water availability everywhere in the Nation, along with comprehensive information about the water needs of our communities and farmlands. Fully effective management will look toward the necessary steps to meet water needs, whether by restoration of underground water levels, storage by diversion into reservoirs for later use, or the elimination of pollution.

Management of our public lands will carry such socially and economically important responsibilities as the preservation of watersheds by reseeding and reforestation, the careful administration of permits for stock grazing, and diligent supervision of mineral leases on the public domain.

The people of our country are recognizing the vast wealth they possess in the great river basins. For generations we watched our rivers rise and fall with the melting of the winter's ice and the rapid runoff of rain the earth could not absorb, seeing only that this was the course of nature throughout the world's history. These rivers today supply great new strengths to our economy and to the lives of the people. Combining imaginative boldness and high technical skill, we have begun to put our rivers to many productive uses. We are bringing water to once arid lands and to other areas where water has been insufficient. The constantly pressing problem of energy for our industrial economy and our daily living is being met increasingly by the production of hydroelectric power made possible by river control. In no area of our natural resources is efficient and careful management so urgently required as in our river-basin developments.

The Department of the Interior is directed to safeguard and to manage the vast resources which we need to maintain and expand our economy. During the last year, the Department has focused attention on programs designed to make these resources more valuable. In the current period of world tension, we must work aggressively to mobilize our resources intelligently to meet any test which may confront us. The present crisis demands that we be prepared to expand our production of minerals, raw materials, food, and energy with the same dynamic vitality that we displayed in World War II.

Minerals

Expanding population and defense needs will place a burden of peak production on our mineral industries. Production of mineral commodities to satisfy our growing demands can be met by a wise and foresighted conservation policy based upon an adequate knowledge of our mineral resources and aided by maximum productive efficiency.

What mineral resources do we possess? We still lack adequate information as to the extent and kinds of minerals in the United States. The major goal of the Geological Survey's program of geologic and mineral resource surveys and mapping is to provide this information. The search for this essential knowledge must be carried forward with intensified zeal.

Geological and geophysical investigations must be expanded during the next 10 years. Many of our essential minerals are being consumed faster than they can be produced from our known domestic deposits. Further, the rate at which we are using up some of them is increasing in the face of a growing difficulty in discovering new deposits.

Geologic mapping, now progressing at a rate of about 1 percent of the country's area per year, is expected to increase shortly to a rate of at least 5 percent per year. Concurrently, the Geological Survey plans to continue expansion of its program so that the search for needed minerals and fuels may be carried to greater depths and into hitherto unproductive areas.

The Department has a major responsibility in the formulation of a national minerals policy, which will have as its basic objective an adequate supply of all mineral raw materials needed to support an expanding industrial economy, a rising standard of living, and the requirements of national security.

For those raw materials in abundant reserve, special attention is being given to the development of technologies which will make them available at the lowest possible costs consistent with sound conservation procedures. For those minerals which are less abundant, on the other hand, the need is for stimulation of searches for new deposits, improved utilization technologies and development of more efficient methods. As domestic minerals decline, the review of foreign sources must be continued.

We are developing an inventory of our mineral resources, together with necessary information and plans for their most effective utilization. Such a program will comprise three closely coordinated types of activity: (1) The examination and development of mineral deposits; (2) laboratory investigations to develop economical methods for recovery of usable products; and (3) translation of this information into programs to meet the foreseeable needs of industry.

An outstanding example of the type of planning now required is found in the problem of supply currently faced by the steel industry. Steel is the most important metal industry in terms both of its size and its influence on the well-being of the Nation. The possibility of providing a continued supply of raw materials for this industry is a matter for urgent attention. The steel industry has always been dependent on imports of manganese and chromite. During the past year, Soviet Russia, chief supplier of manganese, has sharply reduced exports to this country. The Bureau of Mines is devoting intensive efforts to a search for economical methods of extraction from low-grade domestic deposits. It is also seeking to develop a process for recovering manganese from slag deposits at the mill.

Since World War II it has become necessary to take stock of our supply of iron ores. We are rapidly using up our best ores in the Mesabi Range of the Lake Superior region. We are currently using more than 114 million tons of ore to produce about 100 million tons of steel, and peacetime expansion would be expected to raise this drain to 125 million tons of ore within a relatively short time. Accelerated expansion of the steel industry as the result of defense requirements may lead shortly to demands for 136 million tons of ore. A real gap now exists between both our immediate and future needs for iron ore and the supply that is being produced.

We should act promptly to close this gap. There are immense deposits of low-grade silicious iron ores called taconites in the Lake Superior iron region. One of the technological problems to which we must give increased attention is the economic mining and concentration of these ores and the preparation of the concentrate for use in iron blast furnaces. This is so despite the fact that the industry, now seeking to attain an annual output of taconite concentrates amounting to 13 million tons by the end of 1960 and 25 million tons by 1970, is probably devoting more research effort to this than to any other metallurgical problem.

We can also augment our supply of iron ores through increased imports which we can expect as our steel companies develop supplies from other areas. If the rich ores of Labrador are to be made readily available to the great steel centers of the Midwest, the development of the St. Lawrence Seaway is needed and should not be underestimated in any appraisal of an expanding steel industry.

We have other pressing metal and minerals problems which have been accentuated by the national emergency. Development of new metals and alloys and new metallurgical processes offers bright promise for extended use of our common minerals and the conservation of those in short supply. Raw materials from which to make aluminum and magnesium are abundant and facilities for expanding production of these two useful metals must be readily available when needed. Titanium and zirconium, new metals, the ultimate uses of which can only be guessed, are already of extreme importance for specialized uses.

FUELS

As we view the prospect of a continuously expanding population, it is significant to note that our rate of consumption of mineral fuels has outstripped the rate of population growth during the first half of this century. This fact bespeaks both technological development and a rising standard of living.

Consumption of petroleum products is expected to reach 2.3 billion barrels in 1950. By the end of the next 10-year period, it may exceed 3.1 billion barrels, an increase of 38 percent over the present rate of consumption. Viewed on the basis of annual per capita consumption, the increase is even more startling—4.3 barrels in 1920; 7.6 in 1930; 10.1 in 1940; and 15.2 in 1950. The year 1960 should find us using 18 barrels of petroleum for each citizen of America—for heating, for transportation, for chemicals, and for other purposes.

This dramatic increase calls for careful scrutiny of our reserves. Except for the depression years of 1930–34, the supply of petroleum has increased yearly without significant interruption. Growth in natural gas production has been similar, and the increase since World War II has been greatly accelerated by construction of great pipelines. There is no way of knowing the quantity of these fuels ultimately to be recovered from the earth, but the estimated proved reserves of petroleum on December 31, 1949, were 28.4 billion barrels, equal to 14 times recent annual production rates. Similar reserves of natural gas amounted to 180.4 trillion cubic feet, or 29 times current yearly rates of depletion.

It is possible that the consumption of petroleum will exceed domestic discoveries during the next decade, particularly if defense needs should increase the drain greatly. Should this situation develop, there will be a period of several years in which the discrepancy between current consumption and new discoveries will be met by withdrawal from reserves, increased imports from abroad, synthesis from oil shale, or a combination of these sources.

We are forging a research and development program to furnish the scientific, engineering, and economic information required for the production of synthetic liquid and gaseous fuels from our abundant reserves of oil shale and coal. In the laboratories and pilot plants of the Bureau of Mines, scientists and engineers are developing the processes for industrial use which will assure ample supplies when the need arises. We are also engaged in petroleum research designed to improve current production methods and to increase the efficient utilization of oil produced. The application of secondary recovery methods in older oil fields illustrates the finest type of conservation activity: In many instances, the injection of gas, air, or water into underground oil sands has made it possible to harvest a second crop of oil which, in some cases, equalled or exceeded the first recovery. There are even greater opportunities for improvement in primary production practices.

While the economic position of the coal industry is complex, the supply of coal continues abundant. Published estimates of coal reserves, based largely on work done a half-century or more ago, are not sufficiently accurate for current use, and investigations now in progress will be continued to supply exact information on our coal resources.

Essentially all of the growth in the total energy requirements of our economy in the past 30 years has been absorbed by petroleum and natural gas. The coal industry has expanded only in time of war or in the immediate postwar period. In spite of this trend and the current highly competitive state of fuels, the increasing energy markets of the future will probably require large supplies of coal. There are at least three recognizable channels into which coal will be directed: The continued expansion of electric power facilities, probably at the mine; synthetic oil production; and underground gasification of coal for the generation of electric power at the mine.

We intend to press the study and evaluation of the complex factors that influence production and consumption of fuels. The health of our fuel industries is essential to the Nation's economic welfare, and from these studies and evaluations there must evolve a broad national fuel policy designed to bulwark a strong economy.

The increasingly troublesome problem of air and stream pollution in many of our communities is closely related to the continuous expansion of industries processing minerals and mineral fuels.

Expansion of industry, which will continue, means that more airborne wastes are constantly being produced and that in many communities objectionable levels of contamination are being reached for the first time. The serious results of air pollution in Donora, Pa., in 1948 brought the question of air pollution forcibly to our attention.

Discharge of wastes into streams, likewise a serious problem, increases the costs of municipal water purification, destroys recreational facilities, and, in congested mill areas, can raise water temperatures to the point where reuse becomes difficult.

Through the Bureau of Mines, we are continuing our research in waste disposal with the dual objective of conserving resources and maintaining the maximum benefits of pure air and water supplies.

It is important that the human resources in mine and industry be protected and that conditions favorable to efficient production be maintained.

Chief hazards in coal mining are in roof and coal falls and in haulage operations. The mining industry has responded favorably to the Bureau of Mines' program of investigation, research, and service. Approximately 43 million square feet of mine roof have now been supported by the new bolting method which has decreased the accident rate appreciably. Special attention is now being given to finding means to eliminate death and injury in haulage operations.

In addition, investigations and recommendations on industrial hygiene in the mineral industries will be made to eliminate serious hazards to workers from the effects of gases, dusts, or toxic mineral compounds. The growth in these hazards requires new methods of engineering and medical control. There is strong reason to believe that continuation of health and safety programs can reduce the 1949 mineral industry fatality rate of 0.66 to 0.25 per million manhours of exposure by 1960.

Two activities closely associated with inspection and safety programs in our mines are directed toward the conservation of unused coal deposits. One of these is the current program to control fires on the public domain and on private lands which have destroyed many millions of tons of coal. The other, which aims to make available immense tonnages, is a proposed system of drainage tunnels to unwater the Pennsylvania anthracite region. It is anticipated that the studies and plans bearing on this tunnel construction will be finished within 2 or 3 years.

WATER AND POWER

The vital need for integrated water and power development has become increasingly apparent in the postwar period. Our requirements for new land and for electric power are growing steadily in peace. As a result of the international crisis, these requirements may increase drastically.

If our population approaches the estimated 175 million within the next decade, current land and power requirements will mount substantially. In 1950, our 150 million people were supported by the products of about 353 million acres of cultivated land, or approximately 2½ acres per person. The ratio a few years ago was about three acres per person, and only improvements in agricultural science and in the sound use of cropland prevented a reduction in living standards as the ratio fell.

There are signs that we are nearing the ceiling to which we can push the average productivity of our presently cultivated soil. We are also warned that about 180 million acres of farm land are subject to continuing damage from erosion and soil exhaustion. Here is a challenge to our citizens as they plan the expansion of our economy in the next 10 years.

To a considerable extent, the needed new land can be found in the 17 Western States where many millions of potentially fertile acres lie unused or nearly unused as a result of irrigation problems that are too vast to be solved by unaided local units. Aware of this vital resource, Congress has directed that we undertake to reclaim this western land and develop more fully the power of western rivers. The Bureau of Reclamation has continued during the past year a record peacetime construction program designed to add many acres and many kilowatts to our national productive potential.

The amount of farm land which can be brought into production in the West is limited by the amount of water available. Total average runoff in the 17 States is estimated at about 393 million acre-feet of water a year. At present, about 75 million acre-feet are being put to use. Through careful reclamation, nearly 60 million additional acre-feet can be used yearly—about 11 million for household and industrial purposes, and the balance for irrigation.

About 21 million acres of land are now under irrigation in the Western States, but nearly 9 million of these have inadequate water supplies to permit intensive farming or to maintain a stabilized regional economy. By further resource development, these water-short acres can be provided adequate supplementary water. In addition, nearly 7 million acres of new land can be brought into production. Current experiments with rain-making and the recovery of fresh water from the sea may provide, in time, means of increasing these estimates of potential new acreage.

As great as are our needs for increased farm acreage, they are apt to be exceeded in urgency during the next 10 years by our requirements for electric energy to meet the huge demands created by our industrial expansion and our rising living standards. To meet these demands, while conserving our exhaustible supplies of fuels, hydroelectric power development is a foremost priority.

In 1947, we produced about $130 worth of manufactured goods per person. Total industrial activity, transportation and other industrial services, amounted to $1,222 per person. The maintenance of such standards for even 20 million more persons in 1960 requires a 24-billion-dollar increase in annual production—without allowance for added defense production or for expansion of living standards.

The national energy requirements to power this necessary industrial expansion in the next decade are tremendous. In the last quarter of a century we have made marked progress in enlarging our electric power plant, but at the same time the insatiable appetite of American enterprise for power has created phenomenal demands. While the capacity of the United States power plant tripled over the past 25 years and doubled between 1940 and 1948, the output of electric energy from generators has multiplied five times. As rates for electricity have gone down, the use of electricity has gone up. Per capita use more than quadrupled between 1924 and 1948.

Notwithstanding the steady expansion of generating capacity and the increase in output, the supply of electric power in the United States has barely kept up with demand. World War II caused power demands to skyrocket. Brown-outs and other stringent conservation measures were necessary in many parts of the country.

Since the war, power demands have continued their upward spiral. The economic growth of the Pacific Northwest and some other areas has been stunted by lack of sufficient low-cost energy. It is now estimated that the demand for power will have doubled again by 1960 under a growing peacetime economy. In addition, we must recognize that emergency demands are being created by our defense needs for energy to produce ships, tanks, planes, aluminum, and minerals.

Privately owned electric utilities are now in the midst of a large expansion program. They are planning substantial additions to the generating capacity of their plants within the next few years, and are looking ahead to spectacular expansion in the future.

The publicly owned segment of the electric utility industry likewise envisages substantial additions to the national power plant in the near future. In carrying out presently authorized river basin development programs, in connection with federally constructed projects for which the Department of the Interior is the marketing agency, the Federal Government plans to install in plants, now under construction, generating capacity of about 4.5 million kilowatts in hydroelectric facilities, and to add another 3.3 million kilowatts of capacity in the ultimate development of these same projects. Other authorized projects, on which construction has not yet started, will provide another 10 million kilowatts of capacity.

It is estimated that the rivers of the United States can be harnessed to provide nearly 77 million kilowatts of additional hydroelectric capacity, substantially more than the total capacity of our power plant today. Western streams alone can provide nearly 50 million kilowatts of capacity and generate about 270 billion kilowatt-hours a year. For the most part, these streams can generate this power through the use of the same reclamation structures that will control them for irrigation.

The fact that approximately 800 million barrels of precious and irreplaceable oil would be required each year to produce as much electricity as the United States can develop by tapping its unused hydroelectric resources dramatically underlines the importance of water power development as a conservation measure.

Our water and power developments have already paid rich dividends in the economic and social development of our country. In the Pacific Northwest, for example, the availability of low-cost power as the result of river basin developments has inspired extraordinary economic growth. Whereas the average income of the United States increased 129 percent between 1929 and 1947, the average income of the Pacific Northwest increased 202 percent.

The Bonneville Power Administration, which markets power from the Federal plants in operation at Bonneville Dam and at Grand Coulee Dam, indicates sales in the Pacific Northwest area of 13,033,000,000 kilowatt-hours during the 1950 fiscal year. The total generation of energy by the Columbia River system was exceeded only slightly by the Tennessee Valley Authority, the largest system, public or private, in the world. The wartime and postwar growth of population and industry in the Pacific Northwest has already absorbed the entire developed power resources of the area and created a power shortage which will continue for several years. Present construction schedules to provide additions to the power supply, including all private and public projects now in progress, cannot meet the deficiency. The prospect of new and additional demands for power for defense production assures that electric power supply will remain a critical issue to both the economic development of the Pacific Northwest and the security of the Nation for some years to come.

The economic advance of the Southwest is being spurred by the activities of the Southwestern Power Administration, which is now maintaining over 500 miles of high-voltage lines and in the past year marketed over 441 million kilowatt-hours of electric energy.

In the Southeast, a new regional power agency was established during the past fiscal year. The Southeastern Power Administration was created in March 1950 to market electric power generated at Army Corps of Engineers flood control projects in a 10-State area: Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, and West Virginia.

In New England, where power generating capacity increased only 48 percent in the 1929–47 period, as compared to 77 percent for the country as a whole and 146 percent for the Pacific Northwest, income growth has lagged behind the national average.

A new record of achievement in hydroelectric power capacity and production was set on Federal reclamation projects during the 1950 fiscal year when total installed capacity reached 3,218,400 kilowatts, and nearly 20 billion kilowatt-hours of energy were generated. If generated from fuel, this output would have required about 40 million barrels of oil a year.

The total cost of 18 multipurpose projects, including the Missouri River Basin project, now being undertaken is estimated at about 6.3 billion dollars. Total gross revenue from sales of power on these projects, over the period during which repayment of costs is scheduled, will be about 7.2 billion dollars. The net return will be nearly a billion dollars. Further indication of the sound financial foundation of these resource developments is the fact that more than two-thirds of the cost of irrigation facilities is paid for by the returns from the sale of generated power, and the balance by water users.

Crops produced on Federal reclamation projects in 1949 were worth over one-half billion dollars—an average of $105 an acre. The cumulative total gross crop value since 1903 is 6.9 billion dollars, more than three times the investment in the projects to date.

The vast contribution the multipurpose development of our river resources has made to our national strength is high-lighted by many record-making achievements. The water stored in Boulder Canyon, besides watering a half-million acres for growing fruits and vegetables, is also providing power to help make Los Angeles the Nation's first city in the manufacture of aircraft and oil field equipment, and the second in the production of rubber goods and tires. During World War II, Hoover Dam powered shipyards, airplane factories, mines, rubber factories, and the great basic magnesium plant; its capacity to contribute more power for such purposes is being increased. Water stored by Grand Coulee Dam, eventually designed to irrigate a new agricultural realm three-quarters the size of Delaware, is producing power which is building a new industrial empire in the Pacific Northwest. With less than half of its generators on the line during the war, Grand Coulee turned out power equivalent to the labor of a million men working 8 hours a day for 78 years. It helped make ships, planes, tanks, and the atomic bomb. Its capacity is already at least 60 percent greater than it was during the war. More that 140 million dollars has been invested in factories dependent upon Grand Coulee power—10 of them had produced over 700 million dollars' worth of aluminum products by June 1949.

The expanding agriculture, industry, population, and income which are the natural outgrowth of river development projects are clear testimony as to their value to the regional and national economy. They are the fruits of our movement into a new frontier and a harbinger of the greater America that our citizens are building. They are a promise that the needs of coming generations can be met, and that our Nation can continue to lead the world's people toward the kind of living that free men and women can achieve by their united efforts.

The future contribution of river basin development to the progress of our growing Nation will depend upon the decisions the people make today. At present rates of progress, about 50 years will be required to develop fully the West's available irrigation and hydroelectric power potentialities alone. In some regions, a full century will be required.

In order to meet anticipated loads at any particular time in the future it is essential that planning and construction be initiated early enough so that these projects may be completed and be in operation when the loads materialize. It necessarily follows that our present plans for meeting the needs of 1960, for example, must be based mainly on work initiated early in the 1950's.

The Bureau of Reclamation is in the process of developing a 7-year construction program, subject to congressional approval, of projects costing about 3.9 billion dollars—an average of about 550 million dollars per year. Part of this money would be used to complete projects already authorized and the remainder for new projects. If this program is carried out, full irrigation would be provided for about 1.8 million acres of land, or enough for 18,000 new family-size farms, and supplemental irrigation for 3.1 million acres, comprising about 53,000 farms. Land thus brought into stable production would constitute an area equal to that of the State of New Jersey.

This proposed program would add about 3.2 million kilowatts to the generating capacity of the Bureau's plants, almost doubling present capacity, which would reach 6.4 million kilowatts. These totals include estimates of the output of plants built by the Army Corps of Engineers, and marketed by the Bureau. Demand for Reclamation power will be outstripping even these enormous proposed increases, however. The planned increase of 3.2 million kilowatts will fall short by almost 1.5 million kilowatts of estimated peacetime needs.

Besides pushing forward as rapidly as possible in developing the water resources of the country, the Department of the Interior is moving ahead at a record pace in setting up facilities for the trunk-line transmission of electricity from federally constructed plants now operating or under construction. At the same time, numerous cooperative arrangements are being made with rural electric cooperatives and other customers given preference by law to insure them power distribution at low rates.

These projects for development of our river valleys will yield continuing financial returns far into the future. They will, in fact, be reflected in an income curve rising faster during the decade of the sixties than in the fifties. To many, it is of even greater importance that herein lies our opportunity to continue to apply American ingenuity to problems that must be resolved to assure the future welfare of ourselves and our children. Our conquest of our land frontiers won us world-wide admiration. The conquest of our water frontiers will give us land, power, food, new communities, new industries, greater leisure, and a steadily mounting income. Most of all, it will bring the sure and certain realization that we still know how to work together to harness the gifts of nature for the service of man.

Land Resources

Throughout the Nation's history, the growth in our strength has closely paralleled the availablity of land for an increasing population. Pioneering on homestead lands in the West created a rich tradition that symbolizes the conquest of vast natural resources by a strong and virile people. The Nation possessed much land; and farmers, stockmen, lumbermen, prospectors, and railroad builders spread to the Pacific with titles to acreages from the public domain.

With the growth of an industrial economy and the concentration of people in towns and cities, the free land era, when land was offered by the Government in return for the exploitation of its fertility in soil or minerals, came to an end.

Emphasis on efficient management of land resources dominates the Government's activities on the public domain today. Those resources are the common property of the people, whether they be public lands, Indian reservations, or national parks. They have contributed to the wealth and prosperity of the Nation and will continue to be a source of economic and social strength in our efforts to win higher standards of living in the next decade.

There are at present approximately 823 million acres of Federal lands in the United States, including Alaska. Some 181 million acres come within the jurisdiction of the Forest Service of the Department of Agriculture. The Bureau of Land Management of the Department of the Interior was responsible during the past year for the administration of about 500 million acres of public land in the United States and Alaska.

Over one-half of the Federal land in the West is used for grazing livestock. Much of this area is mountainous and the watershed formed by its slopes and plateaus requires constant protection against erosion.

Under the Mineral Leasing Act of 1920, the Bureau of Land Management is responsible for the issuance and legal administration of permits, licenses, and leases under existing laws to protect the oil, gas, and mineral resources of the Nation from waste, while insuring maximum use.

The returns to the people made possible by careful management of the public domain have been demonstrated dramatically. The Bureau of Land Management was established in July 1946 through the consolidation of the General Land Office and the Grazing Service. Since that time, receipts from leases, permits, and other sources have totalled approximately 125 million dollars. Of this amount, more than 50 million dollars was transferred to the Bureau of Reclamation for investment in dams and other western development projects. Nearly 50 million dollars was paid to States and counties for building schools and roads, and for other purposes. Part of the remainder was used for conservation activities and the balance was placed in the Federal Treasury.

Applications for land use increased from 17,000 in the fiscal year 1946 to 34,000 in the fiscal year 1950. Over 8.5 million head of livestock grazed in Federal districts last year. From the revested railroad lands in Oregon were harvested nearly 5 million dollars' worth of timber representing a volume of over 413 million board-feet; this was one result of the Bureau's sustained-yield policy. Revenues from oil and gas, phosphate, and other mineral leases exceeded 29 million dollars.

During the past year the Government collected over 36.1 million dollars from administration of public lands. A beginning was made in the task of microfilming 6.5 million land patents contained in over 11,000 volumes. Cooperating with other Federal agencies and State and local groups, the Bureau has taken the initiative in several important land planning studies, including those for Alaskan development.

The full and wise development of public land resources geared to the needs of an expanding economy requires: (1) A program of soil and moisture conservation which will preserve productivity of important watershed lands, and prevent avoidable erosion; (2) planned programs of management of such harvestable surface resources as timber and forage to promote maximum safe use; (3) a more efficient and simplified administration of publicly owned natural resources; and (4) wise use and careful settlement of land in Alaska.

We must know what land we have in terms of its future usefulness for specific purposes. How much timber can we cut if we are to retain an undiminishing supply? How many head of livestock can be fed on these lands? Where are the watersheds that will require protection? What land can be opened safely to settlement? Where must our minerals be husbanded?

An inventory of our lands and their resources must be accomplished, and cadastral surveys must be made, if classification of lands is to be made possible. Studies must be made of the relationship of these land resources to the national economy, and to the local communities and areas which they immediately affect. We have begun such studies in close cooperation with river basin committees, advisory groups, and State and local authorities. We are striving particularly to achieve area classification of land use both in the States and in Alaska. This type of approach will be highly valuable in the evaluation of such other conservation activities as basin development.

It is only through full knowledge of the land we possess that its maximum usefulness will be achieved and its basic resources safeguarded. Range management must be adapted to the needs of the land first and to the operations of local ranchers afterwards. Wildlife populations must be considered in the allocation of range forage. Timber utilization practices must be directed toward firming up and expanding dependent local communities. Only by a comprehensive and vigorous program can we assure the efficient use of our land resources demanded by an expanding economy.

National Parks

Since the establishment of Glacier National Park in 1906, the people of this country have found enjoyment in the vast and beautiful settings of our national parks. Since the end of hostilities in World War II, they have traveled to these natural areas in great numbers. Close to 32 million people visited the national park areas in the travel year ending September 1949, an increase of about 50 percent over the highest prewar year.

Althought restricted travel during the war years prevented full use of the parks, they were not idle. Many areas were used for special training of men and women in uniform. Some were utilized as hospital, rehabilitation, or rest areas. Over 8 million service men and women visited the parks.

The effective management of our parks will continue to be of utmost importance if they are to provide the benefits we expect from them. Maintenance of facilities, roads, and landscape are of primary importance. Such maintenance problems were high lighted following World War II by the conditions caused by a protracted period of material and labor shortages. It will also continue to be necessary to weigh carefully such potential threats to park lands as overgrazing, logging, or imprudent water diversion. Closely related is the problem of determining whether the national-park type of protection and management is being applied to enough of our land.

While the primary mission of the Service is "to conserve the scenery and * * * objects" in the national parks as is stated in the act of 1916 which established the Service, greater attention will be directed to the full development of the recreational resources of the areas under its supervision.

There is a growing awareness in the Service that a broad program of recreational planning must be undertaken, the need for which becomes of increasing importance as population trends continue upward.

It is inevitable that proposals will be made from time to time for certain types of resource development which, if carried out, would destroy some of the scenic or recreational assets of our park areas. The erection of a needed dam, or the diversion of water, might well undermine these values. In such cases, the issue must be weighed carefully in terms of the long-term best interests of both the Nation and the region. In the case of the Dinosaur National Monument, a decision has been made that the construction of dams at Echo Park and Split Mountain is justified and their authorization has been recommended. On the other hand, it has been decided that the waters of the Colorado River should not be diverted past Grand Canyon National Park; that flood control works should not be permitted to damage Mammoth Cave; and that the national interest does not justify flooding of 20,000 acres at Glacier National Park by a dam at Glacier View.

It is fallacious to declare that the construction of a dam will enhance the scenic or historic values of a national park or monument, and it is only in the rare case—such as Echo Park and Split Mountain—can they be justified. In these cases, it is obvious that if the projects are authorized as recommended, extraordinary efforts and diligence will be exercised so that the pristine beauty of this area will be preserved.

Fish and Wildlife

The people of America have always enjoyed abundant resources in fish and wildlife, which have contributed to our food sources and provided unsurpassed opportunities for recreation.

Growing world populations require protein food supplies beyond the production possible from land areas. Many nations are accordingly turning to the sea to augment these supplies. Within the United States, most of the inshore fisheries have been exploited almost to full capacity, but great, untapped fishery resources remain in the sea. In order to prepare for the requirements of our rapid economic expansion we should be ready to exploit the rich food resources of the sea.

The Department's Fish and Wildlife Service is engaged in a study of tunas and other high sea fishes over a vast area of the mid-Pacific. Prewar Japanese exploration and our own preliminary work indicate the existence of potential tuna resources in these regions comparable with those that have been so highly valuable on our west coast. The proper development of these new resources should provide substantial quantities of food and income for the people of our Nation and of the Pacific Island Territories.

The high cost of discovery, development, and expansion of great oceanic areas is well known. This factor of cost has led to continued exploitation of already discovered fishing grounds by commercial interests with only rare efforts to find new grounds. Such exploratory fishing as that undertaken in the Central Pacific has consequently become a well-recognized Government function for providing new food sources, for the development of new industry and employment, and for relieving strain on stocks of fish in known grounds. That a similar type of investigation must be carried on in many other oceanic areas is becoming rapidly clear.

The Fish and Wildlife Service has also recently undertaken exploratory fishing programs in the North Pacific, in Alaskan waters, in the North Atlantic, and in the Gulf of Mexico. Location of fishery resources, determination of seasonal abundance, improvement of efficiency in operation through testing of gear and vessel equipment—these are necessary steps in fishery investigation. Of possible revolutionary significance to future commercial fishing operations are currant experiments in fish location by sonic and electronic devices.

Exploratory fishing is of particular importance to the future development of the fisheries of Alaska which, after more than 80 years of commercial utilization, still form the basis of the Territory's most important industry. Approximately 250 fishery wholesale and manufacturing establishments in Alaska employ between 25,000 and 30,000 persons and have yielded products valued at more than 100 million dollars annually in recent years.

With the doubling of Alaska's population in the last decade, land use and industrial developments have taken place which will ultimately have an impact on the anadromous fishes of the Territory. Further development, including stream utilization for hydroelectric energy, harvesting of timber for manufacture of pulp, and clearing lands for farming—all will present serious problems in maintaining fish supply. Vigilant control will be required if fishery resources are to survive.

In addition to supplying food, the sea also provides fertilizers for our soil in the form of ocean plants and fish life. Many of the hundreds of fishes not suitable for human consumption can be processed for fertilizer.

Fishing in our inland and coastal waters has become the country's greatest single outdoor sport. During 1949, nearly 15.5 million licensed fishermen enjoyed this type of recreation. Catering to the needs of anglers throughout the Nation is now an important industry.

Conservation through restocking and proper management of waters is essential if fishing is to be continued. In the case of trout waters, for example, natural reproduction and introduction of small fingerlings will no longer maintain adequate stocks. Many of our hatcheries, built before or around the turn of the century, must be modernized to produce greater numbers of legal-size trout. Programs for such modernization are under way.

Stream pollution is a major deterrent to this particular use of our water resources. With increased industrialization and growth of communities, increasing attention must be directed to sewage treatment, abatement of industrial waste disposal in streams, and more effective soil conservation practices.

One out of every seven Americans fishes or hunts, or both. During the last fiscal year, hunting licenses totaled nearly 13 million. A much greater number of persons derive esthetic enjoying from study and observation of wildlife, and from vacationing in areas enhanced by the presence of wildlife. It is important that there be clear recognition of the need for building lines of defense against destruction of our wildlife through a firmly established system of refuges and management areas.

In our efforts to maintain a constant waterfowl and wildlife population, it has become clear that there will always be competition and conflict with other economic interests. We must recognize however, that our wildlife heritage, once damaged, is difficult to reclaim. Already there is great need for additional refuges along the ancestral flyways for migratory waterfowl. The problem of more nesting and feeding grounds is equally urgent.

Predators among the country's wildlife population received continuing attention during the year. Rats and mice, among the most destructive, annually consume or contaminate about 200 million bushels of grain or the production of approximately 8 million acres. Jackrabbits and pocket gophers, existing in relatively small numbers in semiarid regions, are known to multiply tremendously when such areas are irrigated or when other farm practices increase their food supply. Current progress in the development of selective control methods, repellents, and other practices indicates that such techniques can be effectively applied to produce much greater economic and recreational benefits for our country.

In the decade ahead the intelligent conservation of our fish and wildlife resources can play an important part in assuring the kind of America we want to achieve.

INDIANS

In an expanding economy that calls for steadily increasing production, our Indian citizens must be counted upon to contribute their talents and energies to our national wealth. They must be helped to find their rightful place in the national social and economic structure. As our economy becomes more mechanized, the unskilled laborer is fast disappearing in manufacturing, mining, lumbering, and agriculture. The future will offer little advancement for the Indian unless his economic opportunities can be measurably broadened.

The advancing tide of our technological civilization has largely destroyed the economic foundation of the early Indian population, just as it has altered the economic pattern of an earlier America. The old Indian economic pattern cannot be restored as it once existed, and our Indians cannot be isolated from contact with the present-day world. They must be brought closer to the center of the productive process of our economy.

In the meantime, the problem of the Indians must be worked out in terms of safeguarding and developing such resources as they now have, in raising standards of health and education, and in helping to create jobs off reservations that have proved economically inadequate.

The greatest resource the Indians possess is land. An example of the way in which the present land-based economy of the Indians could be expanded is offered in the following illustrations:

Of approximately 45 million acres of Indian grazing land, the owners are actually using about 34 million acres. If the additional 11 million acres could be brought into Indian use, livestock holdings could be increased by approximately 300,000 head of breeding cows. This stock, on the basis of 60 breeding cows per family, would provide an average annual income of $1,200 for 5,000 families.

In 1946, Indians were using 900,000 acres of the available 3,000,000 acres of cropland. Non-Indians were leasing 1,800,000 acres. The value of sales from the crops produced by Indian farmers in 1946 amounted to $7,700,000, or approximately $8.50 per acre. This acreage return could, of course, be increased by more intensive farming methods. Entirely apart from that possibility, if the same rate of return were realized by Indians on the lands in non-Indian use, their income from agricultural production could be increased by 15 million dollars. On the basis of $1,200 per family, this income would benefit 12,500 additional families.

The achievement of these goals would provide a $1,200 minimum income for 34,000 families of the 44,000 who derive some part of their income from agricultural pursuits. A total of 10,000 would remain part-time farmers or farmers operating small units.

Similarly, expanded irrigation projects would add greatly to Indian resources. The total area of Indian lands now irrigated amounts to approximately 540,000 acres. Ultimate development would place 1,285,000 acres under irrigation. If these 745,000 additional acres were divided into 60-acre parcels they would provide an improved income for 12,400 families.

More than 500 million board feet of timber is annually taken from Indian-owned forests. These forests are managed under sustained yield principles. With few exceptions, this timber is harvested by non-Indian operators. It is obvious that expanded Indian income would result if more Indian timber were milled on the reservation and if the milling process were extended to include finished products.

The situation of the Indians today is one of limited opportunity. In 1945, when non-Indian farmers were obtaining a net annual income of $2,541, Indian families received a net income of $501. Many reservations remain essentially underdeveloped. Many Indian groups find it difficult to gain a decent living from their limited land resources and must increasingly turn to industry.

Although the natural resources of the Indians contribute materially to the economy of many Indian and non-Indian communities, full employment of their resources, both physical and human, is far from being achieved. The need for development along lines other than agriculture is clear. Trades and services offer many possibilities for increasing Indian employment. If the Indian human resources are to be utilized, new income producing activities both on and off the reservations will be essential.

Indians of the United States are demonstrating the progress they can make when they are given technical aid. Properly developed programs will not only enable them to accelerate the progress they are making and contribute to our expanding economy, but also make possible eventual withdrawal of Federal supervision.

TERRITORIES

Irresponsible propaganda attacks upon the United States as an expansionist power bent on exploiting the peoples and resources of colonial areas receives its most incisive answer in the development of our Territories.

In the islands of the Caribbean and the Pacific and in Alaska there are nearly 3 million people under the United States flag. Here peoples of many races draw on the resources of our 48 States for as much or more than they contribute to American wealth. Here peoples, who already enjoy a large measure of self-government, look confidently forward to increasing self-government to the fullest extent.

The Office of Territories was created, not as a colonial office but to promote the well-being of citizens of areas not yet admitted to statehood. It is founded on the antithesis of colonialism, for its primary responsibility is to further "the economic, political, and social development of the territories of the United States."

The Territories can be expected to contribute their full share to the expanding economy which the President has called for. That share will be proportionate to the resources of these areas, to the initiative of their citizens, and to the wise planning of government.

Many branches of the Department contribute to territorial needs through their facilities for cooperative planning and cooperative accomplishment. At the same time much of this joint effort is directed toward increasing the initiative and self-sufficiency of the citizens of the areas served.

The work of the Office of Territories contributes to territorial progress in an area where economics, politics, and social evolution are different aspects of the same growth pattern. The Office has promoted progress in all three aspects by devoting attention to assisting the Territories of Hawaii and Alaska in securing statehood. Statehood can be expected to give great impetus to economic expansion in these areas in the next decade.

At the close of the fiscal year the Congress enacted Public Law 600, which gave to the people of Puerto Rico the right to frame their own constitution based on democratic principles. The new law received the vigorous support of the Department and its acceptance through a referendum in Puerto Rico seems certain.

In the Pacific, the people of Guam have been made citizens of the United States and will assume territorial status with a popularly elected legislature. Administrative responsibility for Federal authority is in the course of being transferred to the Department of the Interior. Developments somewhat similar are ahead for American Samoa and the Trust Territory.

All of these political changes, in the Caribbean, in the Pacific, and in Alaska, will contribute greatly to the Nation's economic growth. America has well learned the lesson, written in the blood of her citizens, that a slave people can be neither a happy nor a productive people. This lesson is being brought to bear in the Territories, not through conflict, but through Federal encouragement of the aspirations of men and women who have been created equal in the right to life, liberty, and the pursuit of happiness.

Conclusion

This report has directed attention to the Nation's problems and responsibilities in conserving and intelligently mobilizing its natural resources to meet the needs of an expanding economy. I feel strongly that this task is urgent. We need to develop our resources more fully to meet the requirements of our rapidly growing population and to attain a continuously higher standard of living for our people. We cannot afford to mark time. We must plan soundly and work aggressively to meet the demand for greatly increased production of energy, goods, and food.

We face a great danger as well as a great opportunity. If we waste our irreplaceable resources, we shall place a heavy burden upon our children and our grandchildren. On the other hand, if we soundly conserve our exhaustible resources, develop new sources of supply, and expand our use of our inexhaustible resources, such as water power, we shall have made a rich contribution to the future national welfare.

We cannot close this report without stressing the additional heavy strain which has been imposed on all of our resources by the continued international crisis. To meet the grave threat of Communist imperialism, we are putting our industrial machine into high gear.

The success of this defense production effort will depend first of all upon the adequacy of our natural resources. Lack of a plentiful and expanding supply of power, of minerals, or oil might defeat our cause. With so much at stake, we must make sure that we can do the job.

Oscar L Chapman

Secretary of the Interior.

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Bureau of Reclamation

Michael W. Straus, *Commissioner*

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DESIGN AND CONSTRUCTION

THE BUREAU OF RECLAMATION FORGED AHEAD to a new high in its construction accomplishments for development of irrigable lands and expansion of hydroelectric facilities on projects throughout 17 Western States during fiscal year 1950. Undertaking the unprecedented 387-million-dollar program, the Bureau increased the scope and speed of its operations and ended the year with an all-time record construction achievement.

Contracts in force at the beginning of the year, covering construction and construction equipment and material, totaled nearly 474 million dollars. At the end of the year they totaled 481 million dollars. During the year, 900 new construction and supply contracts were awarded totaling nearly 140 million dollars. The construction contracts alone amounted to 117 million dollars, or about 84 percent of the total awarded.

An indication of over-all accomplishment, in the biggest annual program since Bureau of Reclamation activities started in 1902, is shown by the year's construction progress. Construction work accomplished during the year amounted to a total value of 277 million dollars, the largest annual dollar volume in Reclamation's history.

Spotlighted examples of major project features finished in fiscal year 1950 include four dams on the Missouri River Basin project; two dams on Columbia Basin project; Tracy pumping plant and large segments of Delta-Mendota and Friant-Kern canals on Central Valley project; and Granby Dam, which forms the main reservoir on Colorado-Big Thompson project.

Greater efficiency and stabilization of operations were effected through many progressive developments and improvements within the Bureau's organization, including better coordination of operations between the Branch of Design and Construction and field organizations. Decisions were speeded up, standard designs used more extensively, and many internal administrative improvements made. Certain basic design methods were improved through restudy and unification and by adapting designs to commercial standards whenever practicable.

Noteworthy progress was made in specifications procedures, numerous improvements being worked out in cooperation with contractor organizations. The increased number of bidders and steady reduction of bid prices was at least partly attributable to these improvements. Streamlined bidding and contract awarding procedures expedited initiation of construction, and more uniform contract administration improved field relations with contractors.

Progress in research studies and investigations was furthered during the year, resulting in findings that will lead to better and cheaper construction, improved design of water-control structures, the application of new testing techniques, better control of waterweeds, and other important developments. New studies initiated include one now underway in the Bureau's newly established radioisotope laboratory on the application of radioactive tracer techniques in the studies of weed control and materials research.

Important contributions to national defense and to Nation-wide programs were made by the Bureau, and duplication of effort minimized, through its cooperative work with other agencies. Substantial progress was made in this work in design, research, mapping, and other fields.

The Bureau began tests for the Atomic Energy Commission in the development of heavy, dense concrete to be used in the Commission's structures. Tests were made of concrete aggregates for the Tennessee Valley Authority. Laboratory tests were made to assist the Forest Service in eradicating beetles in national forests; coordinative seismological studies with the Coast and Geodetic Survey and National Park Service were expanded; designs and specifications were prepared for a dam to be built on the Rio Grande by the International Boundary and Water Commission; assistance was given to at least one city in developing its city water supply.

Countries world-wide also benefited from Bureau technical assistance during the fiscal year, helping to cement friendly international relations, and promote cooperative world progress. Foreign officials from some 37 different countries visited and studied Reclamation projects. Engineering trainees from 14 foreign countries studied Bureau engineering practices at its engineering offices and laboratories. First-hand engineering assistance was given by the Bureau and its technicians to a dozen or more widely scattered countries, involving many thousands of miles of travel.

All told, the Bureau of Reclamation through its multiple activities during fiscal year 1950 made notable progress toward helping to strengthen the Nation and contribute to its expanding economy. Internationalwise, it exemplified the United States Government's efforts to aid other democratic countries in achieving full development and economic progress, pointing the way to eventual world peace.

Contracts Awarded

Major contracts awarded during the year included such extensive construction as the Olympus and Pole Hill tunnels on the Colorado-Big Thompson project in Colorado, the Tecolote tunnel on the Cachuma project in California, Trenton Dam on the Missouri River Basin project in Nebraska, and the Duchesne Diversion Dam and tunnel on the Provo River project in Utah. A summary of the major contracts awarded is given in table 1.

Table 1.—*Major Bureau of Reclamation contracts awarded in fiscal year 1950*

Feature	Project	Amount of award
2 miles Olympus tunnel and 5 miles Pole Hill tunnel	Colorado-Big Thompson	$4, 787, 874
6 miles Tecolote tunnel	Cachuma	4, 750, 455
Trenton Dam	Missouri River Basin	4, 726, 557
Duchesne Diversion Dam and 6 miles Duchesne tunnel	Provo River	4, 379, 961
21 miles Delta-Mendota canal	Central Valley	4, 273, 872
23 miles Friant-Kern canal	do	3, 333, 156
17 miles Friant-Kern canal	do	3, 176, 814
19 miles Delta-Mendota canal and Firebaugh wasteway	do	3, 067, 484
29 miles Mohawk canal and 13 miles protective dike No. 1	Gila	2, 412, 645
Carter Lake Reservoir	Colorado-Big Thompson	2, 389, 350
8 miles Delta-Mendota canal	Central Valley	2, 173, 888
Unit 7, Coachella Valley distribution system	All-American canal system (Boulder Canyon).	2, 070, 089
Grand Coulee Dam—river channel improvements	Columbia Basin	1, 691, 666
Keyhole Dam	Missouri River Basin	1, 667, 724
16 miles East Low canal and Weber wasteway	Columbia Basin	1, 649, 982
10 miles South Coast conduit	Cachuma	1, 582, 886
Wellton-Mohawk pumping plant	Gila	1, 577, 907
Unit 2, Southern San Joaquin municipal utility district, Friant-Kern canal distribution system.	Central Valley	1, 572, 639
10 miles Wellton-Mohawk canal	Gila	1, 556, 387
Miscellaneous electrical installations at Davis Dam	Davis Dam	1, 508, 803

Construction Progress

Acceleration of construction brought several major features on many projects to completion, some ahead of schedule. Of the four major structures—Heart Butte, Angostura, Medicine Creek, and Enders Dams—completed on Missouri River Basin project, two were finished much earlier than contracts required. Heart Butte, scheduled for completion by November 1950, was actually completed in December 1949. Medicine Creek Dam, planned for completion by November 1951, was finished in December 1949, almost 2 years earlier than required under the contract. Granby Dam and Reservoir on Colorado-Big Thompson project, and Tracy pumping plant of Central Valley project, were also completed.

A Bureau record for excavation and earth-placing operations was made at Bonny Dam, Missouri River Basin project, in November 1949 when 1,280,000 cubic yards were excavated and 1,100,000 cubic yards of earth filled. A high monthly record for concrete placement was set in June at Hungry Horse Dam, largest Bureau dam now under construction, when approximately 123,000 cubic yards of concrete were placed. Another record achievement was chalked up for the Bureau with the rapid reconstruction of the 1914-built tunnel No. 3 on Grand Valley project in Colorado, which collapsed March 9, 1950, as the result of a landslide. Awarded a contract March 16, the contractor rushed the work and holed through April 27, about a month ahead of schedule, thus assuring a water supply for 29,000 acres of highly developed land on the project.

Grand Coulee pumping plant was advanced to 83 percent of completion during the year, while the contract called for only 54 percent. Soap Lake siphon, Columbia Basin project, was 80 percent completed by year's end, but only 55 percent of the contract time had elapsed. The first unit of Kortes power plant was placed in operation June 30, the first power plant on the vast Missouri River Basin project to generate power. Although severe winter conditions and other factors retarded progress on construction of Kortes Dam and the power plant, work progressed to about 85 percent of completion.

When the year ended, construction was in progress on 14 storage dams and 3 diversion dams, 11 power plants, 6 pumping plants, 20 miles of tunnels, 500 miles of main canals, and 2,200 miles of transmission lines.

PRINCIPAL FEATURES COMPLETED

Principal features completed on Bureau of Reclamation projects this year are shown in table 2.

TABLE 2.—*Principal features completed on Bureau of Reclamation projects in fiscal year 1950*

Feature	Project	State
Heart Butte Dam	Missouri River Basin	North Dakota.
Angostura Dam	do	South Dakota.
Medicine Creek Dam	do	Nebraska.
Enders Dam	do	Do.
Railroad relocation at Boysen Dam	do	Wyoming.
Williston-Garrison transmission line	do	North Dakota.
O'Sullivan Dam	Columbia Basin	Washington.
South Coulee Dam	do	Do.
Tracy pumping plant	Central Valley	California.
Railroad relocation at Shasta Dam	do	Do.
41 miles of Friant-Kern canal	do	Do.
13 miles of Delta-Mendota canal	do	Do.
Granby Dam	Colorado-Big Thompson	Colorado.
Tunnels 2, 3, 4, and 5 of Horsetooth Feeder canal.	do	Do.
Glendive-Miles City transmission line	Fort Peck	Montana.
Fort Peck-Williston transmission line	do	Montana-North Dakota.
Unit 6, Coachella Valley distribution system	All-American Canal system	California.

Continuing Program

The structures tabulated in table 3 are among the major features expected to be placed under construction on Bureau of Reclamation projects during fiscal year 1951. These include nine dams, three power plants, three pumping plants, over 1,000 miles of transmission lines, 170 miles of canals, and laterals to serve over 121,000 acres of irrigable lands.

Table 3.—*Major features expected to be placed under construction on Bureau of Reclamation projects in fiscal year 1951* [1]

- Columbia Basin project:
  - Blue Lake pumping plant, Washington
  - Quincy pumping plant, Washington
- Central Valley project: Folsom power plant, California
- Cachuma project: Cachuma Dam, Calif.
- Boulder Canyon project: Installation of three generating units in Hoover power plant, Arizona-Nevada
- Gila project:
  - 44 miles Mohawk Canal, Ariz.
  - Mohawk Lateral Unit to serve 36,000 acres, Arizona
- All-American Canal system: Unit 9, Coachella Valley distribution system to serve 10,000 acres, California
- Paonia project: 24 miles Fire Mountain Canal, Colo.
- Eden project:
  - 20 miles Eden Canal enlargement, Wyoming
  - Laterals to serve 20,000 acres, Wyoming
- Provo River project: Terminal Reservoir, Utah
- Rio Grande project:
  - 79 miles Socorro-Albuquerque transmission line, New Mexico
  - 50 miles Bernardo-Willard transmission line, New Mexico
- Missouri River Basin project:
  - Anchor Dam, Wyo.
  - Bixby Dam, S. Dak.
- Missouri River Basin project—Con.
  - Tiber Dam, Mont.
  - Missouri Diversion Dam, Mont.
  - 30 miles Angostura canal system, South Dakota
  - Courtland laterals to serve 16,000 acres, Nebraska
  - 700 miles transmission lines, Transmission Division, Montana, North Dakota, South Dakota, and Colorado
- Riverton project:
  - 27 miles Muddy Ridge canal, Wyo.
  - Wyoming canal laterals to serve 20,000 acres, Wyoming
  - Muddy Ridge laterals to serve 19,000 acres, Wyoming
- Colorado-Big Thompson project:
  - Willow Creek Dam, Colo.
  - Carter Lake Dam, Colo.
  - Rattlesnake Dam, Colo.
  - Flatiron Afterbay, Colo.
  - Pole Hill power plant, Colo.
  - Flatiron pumping plant and power plant, Colorado
  - Willow Creek power plant, Colorado
  - 11 miles St. Vrain supply canal, Colorado
  - 13 miles North Poudre supply canal, Colorado
  - 2 miles Rattlesnake Tunnel
  - 170 miles transmission lines, Colo.

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[1] Subject to such changes as may be necessary to meet national defense requirements and congressional actions.

Major features of Bureau projects expected to be completed in fiscal year 1951 are listed in table 4. These structures include nine dams, four power plants, two pumping plants, 2,300 miles of transmission lines, 40 miles of canals, laterals to serve 14,000 acres, and 6 miles of aqueducts.

TABLE 4.—*Major features on Bureau of Reclamation projects expected to be completed in fiscal year 1951* [1]

Feature	Project	State
Kortes Dam and power plant	Missouri River Basin	Wyoming.
Shadehill Dam	do	South Dakota.
Cedar Bluff Dam	do	Kansas.
Dickinson Dam	do	North Dakota.
Bonny Dam	do	Colorado.
Superior Courtland Diversion Dam	do	Nebraska.
885 miles transmission lines Transmission Division.	do	North Dakota, Wyoming, Nebraska.
Angostura power plant	do	South Dakota.
Anderson Ranch Dam and power plant	Boise	Idaho.
North Coulee Dam and feeder canal	Columbia Basin	Washington.
Tracy switchyard	Central Valley	California.
228 miles Shasta-Tracy east side transmission line.	do	Do.
216 miles Shasta-Tracy west side transmission line.	do	Do.
18 miles Wellton-Mohawk canal	Gila	Arizona.
Unit 7, Coachella Valley distribution system	All-American Canal System	California-Arizona.
500 miles transmission lines	Davis Dam	Arizona-Nevada.
6 miles Salt Lake aqueduct	Provo	Utah.
Fort Sumner Diversion Dam	Fort Sumner	New Mexico.
15 miles main canal	do	Do.
180 miles transmission lines	Fort Peck	Montana.
70 miles Seminoe-Casper transmission line	Kendrick	Wyoming.
Estes and Marys Lake power plants	Colorado-Big Thompson	Colorado.
Granby pumping plant	do	Do.
5 miles Poudre Supply canal	do	Do.
220 miles transmission lines	do	Do.

[1] Subject to such changes as may be necessary to meet national defense requirements and Congressional actions.

COST TRENDS

The costs of many basic materials for Bureau of Reclamation work and labor costs continued to rise during the year. Steel, lumber, copper, zinc, and other building materials rose in price as activity of the construction industry increased. Although the cost of living declined somewhat early in the year, it again rose near the end of the year and wages increased accordingly.

The cost of nearly all Bureau construction work declined, however, as indicated in table 5. No increase is shown in any of the types of work listed, and only three items, all of which required the use of large quantities of steel, remained the same in June 1950 as they were in July 1949. This is attributed to increased competition among bidders for most work.

As contractors cut their unit prices where stiff competition prevailed, it was evident that they were operating on a smaller margin of profit. Other factors enabled contractors to reduce their bids, including the

TABLE 5.—*Bureau of Reclamation cost indexes—fiscal year 1950*

Cost indexes based on January 1940 costs=1.00	July 1949	January 1950	June 1950
Dams:			
Earth	2. 15	2. 10	1. 85
Concrete	2. 15	2. 15	1. 95
Pumping plants:			
Building	2. 30	2. 25	2. 25
Equipment	1. 75	1. 70	1. 70
Discharge pipes	2. 10	2. 10	2. 10
Canals and conduits:			
Canals	2. 30	2. 15	2. 15
Conduits	2. 30	2. 20	2. 20
Laterals and drains	2. 45	2. 40	2. 35
Power plants, hydro:			
Building	2. 30	1. 90	1. 90
Equipment	1. 75	1. 75	1. 75
Penstocks	2. 10	2. 10	2. 10
Transmission switchyards and substations	1. 75	1. 70	1. 70
Transmission lines (wood pole)	2. 35	1. 95	1. 80
Roads and bridges:			
Primary roads, surfaced	2. 20	2. 10	1. 95
Secondary roads, unsurfaced	2. 15	2. 05	1. 80
Bridges	2. 25	2. 10	2. 05
Composite index	2. 20	2. 15	2. 00

decreased cost of earth-moving operations. Such work requires a minimum of labor, and materials and costs were lowered by increased efficiency of large earth-moving equipment.

In addition, equipment and materials were in much better supply and it was unnecessary to include contingency items previously required to cover possible delays in obtaining materials and equipment or in making costly substitutions. Labor was in good supply, resulting in greater efficiency of operations and increased production efficiency.

DEVELOPMENTS IN SPECIFICATIONS REQUIREMENTS

New specifications methods were adopted to assist contractors in preparing their bids for Bureau work. Specifications procedures were initiated aimed at minimizing the inclusion of contingency costs in bid prices.

To provide for progress payments under the lump-sum price for water control and care of the river during construction, a method was adopted to permit the contractor to submit a breakdown of his water-control plan. The contractor was thus permitted to allocate the total lump-sum price into 12 major divisions of work. When approved, the allocation and the water-control plan became a part of the contract and monthly estimates for progress payments.

Specifications paragraphs regarding extra work and contractors' protests were modified to provide for a more equitable and expeditious procedure in handling and processing contract adjustments. Construction specifications were individually analyzed for division of work into smaller schedules to give small contractors an opportunity to bid. Provision was made in many specifications for final acceptance of work completed but which constituted only a portion of the total contract; thus contractors were relieved of responsibility for maintenance of the completed and accepted portions.

The construction contract bid form and the specifications paragraph relating to commencement, prosecution, and completion of work were modified to expedite start of construction. Although the Bureau is still furnishing items of large quantity and specially designed metal work and operating equipment, specifications were prepared providing for the contractor to furnish the major portion of construction material.

Early in the year, Bureau engineers' estimates of the cost of performing construction work by contract were published for the first time, permitting contractors to compare bids with the engineers' estimates, thereby assisting the contractors in planning future work.

DESIGN AND OPERATING-CRITERIA DEVELOPMENTS

Coordination of field design activities with the Chief Engineer's office in Denver and the development of closer liaison between these offices speeded design and specification work materially. The program of inspection to assure satisfactory service conditions and functions of Bureau of Reclamation structures and facilities, initiated in fiscal year 1949, was conducted successfully. In all, about 250 major structures were inspected since start of the program, and work totaling approximately $2,000,000 was accomplished as a result of inspection recommendations.

To assure proper and efficient operation of installed equipment and machinery, operating criteria and instructions were issued to operators of Bureau power plants, pumping plants, dams, and canal systems. Information was provided to field design offices preparing operating instructions for delegated design work. Progress in standardization of operation instructions continued, and instructions prepared for the operation of appurtenant works of dams, and test apparatus for earth and concrete dams.

A panel of engineers reexamined all basic design criteria for concrete dams, making many revisions. The panel reviewed results of observations of instruments embedded in Bureau dams such as Grand Coulee and Shasta, and also considered applicable data from such outside agencies as Tennessee Valley Authority and the Corps of Engineers. New criteria that may effect important economies in construction of future concrete gravity dams were being considered at year's end.

Administrative Developments

Concurrent with the expanded design and construction activities, increased emphasis was placed on continued improvement of the engineering staff and administrative functioning.

A notable development was the initiation of annual conferences of Bureau construction engineers during the winter season when major construction activity is curtailed. The first conference, devoted to discussions of technical and administrative procedures, was held in February in Denver. Aimed at improved control procedures and uniform construction standards, the conference stressed design and specifications requirements and construction practices, and resulted in better all-around understanding of over-all objectives.

As the result of a development program for recruitment and training of construction engineers, initiated during the year, 70 engineers were selected as potential construction engineers from those who applied for training and from those nominated by the Bureau's regions. At the peak period this year, more than 300 young engineers participated in the program for developing young engineers under the rotation plan, initiated last year with a group of 50. Under the plan, participants move from one assignment to another every 3 months, thus gaining diversified engineering experience, and providing the Bureau with a more flexible work force. When the work load is heavy in one part of the engineering organization, rotatees are reassigned to balance the load. Also, during the year, more than 100 young men were given 90-day field assignments to round out their experience.

An operation and maintenance liaison representative was appointed on the Chief Engineer's staff in March 1950, in order to assure that significant information regarding operation and maintenance experience and requirements is made available to design and construction engineers. Data concerning operation and maintenance activities were compiled for use in developing improved design and construction practices.

A management survey of the Bureau's design and construction functions, completed in 1949, resulted in clarification of branch and field offices' responsibilities. Specific recommendations based on the survey strengthened coordinated activities and improved over-all efficiency of design and construction operations.

An Assistant Chief Engineer was appointed in the fall of 1949 to assist the Chief Engineer in directing the technical and administrative functions of the Branch of Design and Construction.

Research

The Bureau's research laboratories in Denver intensified activities in the investigative and testing fields. Major efforts were directed toward studies of construction materials and verification of designs through the use of structural and hydraulic models, as well as investigations of new construction materials and processes which would lead to better and cheaper construction.

An important addition to the laboratories was the installation of a 5-million-pound universal testing machine, used to determine the strength and elasticity of construction materials in both tension and compression. With facilities for testing large specimens up to 32 feet in length, the machine made possible investigations of structure models outside the realm of ordinary testing. One result of the machine's use indicated that large, low-alloy, high-strength steel members could be successfully welded.

Another addition to research facilities was the establishment of a new radioisotope laboratory, headed by a scientist trained at the Atomic Energy Commission's laboratories in Oak Ridge, Tenn. Here, initial studies were begun on the application of radioactive tracer techniques in the studies of weed control and materials research. The laboratory is expected to assist research engineers in the solution of many complex problems heretofore unsolvable by conventional methods.

An important conclusion, resulting from continuing investigations of pozzolanic cementing materials, was the decision to use fly ash in the concrete for Canyon Ferry Dam on the Missouri River Basin project in Montana, the second dam to contain this material. It is also being used in the concrete for Hungry Horse Dam now under construction in Montana. Fly ash, a waste product from steam power plants using powdered coal as fuel, insures a concrete of better quality where, as at Canyon Ferry, for example, the aggregate for the concrete is found to be reactive with alkalies in portland cement. Fly ash, together with certain admixtures, was also shown to improve the pumpability of cement grouts used extensively in construction work to solidify foundations and fill in areas of fractured rock and voids behind tunnel linings.

In connection with the pozzolanic studies, it was indicated that certain pozzolans would reduce the cracking tendencies of concrete made with the reactive aggregates found in certain areas in Nebraska and Kansas. As a result, portland-pozzolan cement will be used in the concrete for Trenton Dam to be constructed in Nebraska.

The strain-relief testing technique for determining existing stresses in rock was further developed in the laboratories, and applied to Diablo Dam for the city of Seattle to measure stresses in that structure. Additional data were obtained in the strength of mass concrete under triaxial loading, leading to a better understanding of the factors of cohesion and shearing resistance of concrete in dams.

A new chemical, rosin amine D acetate, was found to be effective in destroying algae growths in drains. Applications of this compound in the field, carried out by laboratory personnel, immediately reduced the maintenance required to keep drains and ditches open.

In the field of earth controls, the laboratories prepared a classification chart outlining the various types of soils and defining their physical properties. This chart proved valuable to field engineers and the Denver laboratories in coordinating field data on earth materials. A field permeability test to determine probable water losses in canals was also developed. Stabilization and drainage of soils by an electro-osmotic process were studied and applied on certain canals on Bureau projects.

New basic data in the field of hydraulics, compiled by research engineers, contributed to improved design of water-control structures. Particular emphasis was given to problems of silt deposition and sedimentation, and to methods for reducing scour and aggradation in unlined canals. An electric analog computer, devised for evaluating flows in estuarine channels, was utilized in the studies of flow in the Sacramento-San Joaquin Delta area in California, resulting in savings that significantly lowered design and construction costs. Corrective measures to solve the troublesome problems of water-surface surging in the open stands of pipe irrigation systems were obtained from cause-determining studies.

Experiments were conducted to develop new and cheaper materials and methods for lining irrigation canals, including the use of asphaltic membranes and novel methods for applying them. These linings, very low in first cost, were applied on reaches of certain canals with marked success. Patent application was made on a prefabricated buried asphalt membrane canal lining, and the lining was utilized on several installations.

PUBLICATIONS

Marked progress and increased activity featured the preparation and issuance of publications relating to the technical work of the Bureau. Publications issued reflect a wide diversity of engineering knowledge acquired and disseminated in Bureau design and construction operations, including new important contributions to the profession.

Major technical publications issued during the year include: The fifth edition of Concrete Manual, a handbook of information and instruction on concrete construction; a new edition of Hydraulic and Excavation Tables; the Arc-Welding Manual, containing information on the design and control of welded steel construction; engineering monographs; and a group of bulletins completing the series recording results of studies, investigations, and the more unusual problems of design and construction in developing Boulder Canyon project.

Two publications were prepared for issuance in the next fiscal year, namely, the Earth Construction Manual, bringing together engineering practices and procedures developed in earth materials testing and construction; and the Paint Manual, recording the procedures and techniques for control of paints and protective coatings. Other publications planned for fiscal year 1951 include manuals on safety, bituminous construction, hydraulic laboratory and materials laboratory subjects, and additional engineering monographs.

Work Performed with and for Other Agencies

The Bureau was again called upon to assist outside agencies and other Government departments in design and research work covering a widely diversified field of engineering, and continued mutually beneficial cooperative undertakings.

Detail work continued on designs and specifications for Falcom Dam and power plant, to be constructed by the International Boundary and Water Commission on the Rio Grande near Laredo, Tex.; hydraulic models of the spillway and outlet works were constructed; and Bureau laboratories continued testing materials proposed for use in constructing the dam.

Through a cooperative agreement with the city of Seattle, an analysis was made of the structural behavior of Ross Dam, based on extensive data obtained from instruments imbedded in the concrete of the dam. The instrument readings were analyzed to determine how the dam is performing under loading. Also, stress measurements on Diablo Dam were made for the city of Seattle, and laboratory tests made of the properties of the concrete in the dam.

Tests were begun for the Atomic Energy Commission in the development of heavy, dense concrete to be used in the Commission's structures. Concrete aggregates were tested for the Johnsonville steam plant of Tennessee Valley Authority. And tests were conducted on concrete core specimens of the Copper Basin Dam for the metropolitan water district of California.

Paints stocked by the Bureau of Federal Supply centers were tested by the Bureau for performance with purchase specifications. Bureau of Reclamation laboratories assisted the United States Forest Service in its campaign to eradicate beetles in national forests by conducting tests for the chemical control of the dichlorobenzenes used in the beetle eradication. The city of Kennewick, Wash., was assisted in development of its water system.

Coordination of the Bureau's mapping activities, particularly those using aerial photography, with the mapping programs of Geological

Survey, Army Map Service, Coast and Geodetic Survey, and Soil Conservation Service, were continued to insure that no duplication occurred. The Bureau awarded contracts for aerial photography and mapping for areas in California, Colorado, Montana, New Mexico, North Dakota, Texas, Utah, and Wyoming.

In order to meet the Bureau's requirements for special high-dam design data, and requirements of the Coast and Geodetic Survey for the latest seismic information, coordinative seismological studies of the Bureau, the United States Coast and Geodetic Survey and the National Park Service were continued and expanded at Hoover, Shasta, and Hungry Horse Dams.

International Cooperation

Increased demands upon the Bureau of Reclamation for technical assistance to foreign countries were made during the year. Existing legislation made possible Bureau assistance to foreign countries in the fields of irrigation, drainage, hydroelectric power development, and comprehensive planning for multiple-purpose projects. In fulfilling the demands, the Bureau received considerable valuable information through certain exchange arrangements for technical data.

Approximately 200 foreign officials and engineers from some 37 countries toured Reclamation projects and visited the Bureau field offices. About 50 engineering trainees from 14 foreign countries studied Bureau engineering practices in the Denver engineering offices and laboratories.

Numerous requests were filled by the Bureau for specific engineering information, technical assistance and guidance. Bureau engineering assistance was given to Greece, Portugal, Turkey, France, and Korea, at the request of the Economic Cooperation Administration. Engineers were sent to Japan and islands of the Pacific to aid in construction of irrigation and conservation projects, at the request of the Departments of the Navy and Army. Other engineers went to Australia, Pakistan, Puerto Rico, and New Zealand to lend assistance.

Requested by the Department of State, Bureau engineers assisted with certain preliminary work in connection with the proposed Maraetai Dam in New Zealand, and Kosi Dam in India. Under similar arrangement, earth materials tests were conducted in Bureau laboratories for the proposed Gal Oya Dam in Ceylon and for the Hirakud Dam in India.

Requests by mail from other countries and individuals throughout the world for Bureau publications and prepared data on a diversity of complex problems continued to increase. Many were first requests;

TABLE 6.—*Bureau of Reclamation dams*

State and project	Name of dam	River	Type	Capacity	Height	Length	Volume	Year
Arizona:								
Salt River	Bartlett	Verde	Concrete multiple-arch	[2] 179, 500	287	1, 063	182, 000	1939
	Cave Creek [1]	Cave Creek	do	11, 000	109	1, 648	18, 775	1923
	Horse Mesa	Salt	Concrete arch, power plant	[2] 245, 100	300	803	162, 000	1927
	Mormon Flat	do	do	[2] 57, 900	224	505	59, 900	1925
	Roosevelt	do	Masonry arch-gravity, power plant.	[2] 1, 398, 000	280	1, 125	355, 800	1911
	Stewart Mountain	do	Concrete arch, power plant	69, 800	207	1, 260	120, 500	1930
Arizona-California:								
Parker Dam Power	Parker [1]	Colorado	do	717, 000	320	856	380, 000	1938
Arizona-Nevada:								
Boulder Canyon	Hoover (Boulder)	do	Concrete arch-gravity, 2 power plants.	31, 142, 000	726	1, 244	4, 400, 000	1936
Davis Dam	Davis	do	Earth, power plant	1, 820, 000	200	1, 600	4, 357, 500	(4)
California:								
Cachuma	Cachuma	Santa Ynez	Earth	312, 000	275	2, 975	6, 600, 000	(4)
Central Valley	Friant [1]	San Joaquin	Concrete gravity	521, 000	319	3, 488	2, 135, 000	1942
	Keswick [3]	Sacramento	do	23, 800	159	1, 046	197, 000	(4)
	Shasta	do	Concrete curved-gravity, embankment wing, power plant.	4, 493, 000	602	3, 460	6, 541, 000	1945
	Martinez	Offstream	Earth		38	1, 200	183, 450	1947
Orland	East Park	Little Stony Creek	Concrete arch-gravity	51, 000	139	226	15, 745	1910
	Stony Gorge	Stony Creek	Concrete slab-and-buttress	[2] 50, 200	139	868	43, 100	1928
Colorado:								
Colorado-Big Thompson	Carter Lake	Offstream	Earth (2 dikes)	117, 000	200	1, 235	2, 900, 000	(4)
	Dixon Canyon	do	Earth	(5)	240	1, 215	3, 004, 000	1949
	Granby	Colorado	do	546, 000	245	885	2, 901, 300	1950
	Green Mountain	Blue	Earth, power plant	154, 600	300	1, 150	4, 406, 000	1943
	Horsetooth	Offstream	Earth	147, 000	150	1, 610	1, 890, 000	1949
	Marys Lake [3]	do	Earth (2 dikes), power plant	700	40	1, 300	60, 500	(4)
	Olympus [1]	Big Thompson	Concrete gravity, embankment wing.	2, 850	60	1, 850	300, 000	1949
	Shadow Mountain	Colorado	Earth	15, 000	44	600	210, 000	1946
	Soldier Canyon	Offstream	do	(5)	220	1, 420	3, 288, 000	1949
	Spring Canyon	do	do	(5)	215	1, 115	2, 213, 000	1948
Fruit Growers	Fruit Growers	Alfalfa Run	do	4, 600	55	1, 520	135, 500	1938
Mancos	Jackson Gulch	Offstream	do	10, 000	181	1, 895	1, 988, 000	1948
Pine River	Vallecito	Pine	do	129, 700	162	4, 010	3, 738, 000	1941
Uncompahgre	Taylor Park	Taylor	do	[2] 106, 200	206	675	1, 115, 100	1937
San Luis Valley	Platoro	Conejos	do	67, 000	155	1, 525	940, 000	(4)

Idaho:								
Minidoka	American Falls	Snake	Concrete gravity, embankment wings.	[2] 1, 700, 000	94	5, 227	313, 600	1927
	Jackson Lake	do	do	[2] 847, 000	70	4, 920	491, 700	1911
	Minidoka [1]	do	Earth with concrete power house section, power plant.	[2] 95, 200	86	4, 475	257, 300	1906
	Grassy Lake	Grassy Creek	Earth	15, 500	118	1, 170	541, 600	1939
	Island Park	Snake, Henrys Fork	do	127, 600	91	9, 448	464, 000	1938
Idaho-Oregon:								
Boise	Anderson Ranch	Boise, North Fork	Earth, power plant	498, 200	456	1, 350	9, 653, 300	(4)
	Arrowrock	Boise	Concrete arch-gravity	[2] 286, 600	354	1, 150	636, 000	1915
	Cascade	Payette, North Fork	Earth	700, 000	107	785	395, 000	1948
	Deadwood	Deadwood	Concrete arch	164, 000	165	749	56, 400	1931
	Deer Flat, Upper	Offstream	Earth	190, 100	74	4, 000	1, 245, 000	1908
	Deer Flat, Lower	do	do		46	7, 200	1, 240, 000	1908
	Deer Flat, Middle	do	do		16	950	22, 500	1908
Kansas:								
Cedar Bluff (Missouri River Basin).	Cedar Bluff	Smoky Hill	do	368, 100	103	11, 000	8, 917, 000	(4)
Kansas-Colorado:								
St. Francis (Missouri River Basin).	Bonny	South Fork, Republican	do	175, 000	160	9, 265	8, 530, 000	(4)
Montana:								
Bitterroot	Como	Rock Creek	do	34, 800	65	2, 550	1, 106, 000	1910
Hungry Horse Dam	Hungry Horse	Flathead, South Fork	Concrete arch-gravity power plant.	3, 500, 000	564	2, 115	2, 900, 000	(4)
Huntley	Anita	Offstream	Earth	[2] 400	42	1, 050	142, 800	1937
Milk River	Fresno	Milk	do	129, 100	111	2, 070	2, 105, 000	1939
	Nelson	Offstream	Earth (5 dikes)	85, 500	28	9, 900	232, 600	1915
	Sherburne Lakes	Swiftcurrent Creek	Earth	[2] 66, 100	96	1, 086	227, 600	1921
Sun River	Gibson	Sun, North Fork	Concrete arch	[2] 105, 000	196	960	167, 500	1929
	Pishkun	Offstream	Earth (8 dikes)	46, 400	50	9, 180	599, 300	1921
	Willow Creek	Willow Creek	Earth, semihydraulic fill	[2] 32, 400	93	650	254, 186	1911
Canyon Ferry (Missouri River Basin).	Canyon Ferry	Missouri River	Concrete, gravity	2, 050, 000	220	1, 010	455, 600	(4)
Nebraska:								
Frenchman-Cambridge (Missouri River Basin).	Enders	Frenchman Creek	Earth	74, 000	134	2, 603	1, 951, 000	1950
Mirage Flats	Box Butte	Niobrara	do	31, 300	87	5, 508	1, 422, 000	1946
Frenchman-Cambridge (Missouri River Basin).	Medicine Creek	Medicine Creek	do	93, 000	180	5, 630	2, 883, 000	1950
	Trenton	Republican	do	172, 000	95	7, 800	(6)	(4)
Nebraska-Wyoming:								
North Platte	Guernsey	North Platte	Earth, power plant	48, 100	135	560	586, 200	1927
	Lake Alice, Upper	Offstream	Earth	11, 400	30	3, 100	240, 600	1913
	Lake Alice, Lower	do	do		23	2, 550	119, 000	1912
	Minatare	do	do	[2] 60, 800	63	3, 700	696, 100	1915
	Pathfinder	North Platte	Masonry arch-gravity	[2] 1, 070, 000	214	1, 070	65, 700	1909
	Pathfinder dike	do	Earth		38	1, 650	152, 200	1909
Nevada:								
Humboldt	Rye Patch	Humboldt	do	[2] 179, 000	80	914	356, 300	1936
Newlands	Lahontan	Garson	Earth, power plant	[2] 273, 600	162	5, 400	733, 100	1915
	Lake Tahoe [1]	Truckee	Concrete slab-and-buttress, lake outlet regulator.	[2] 732, 000	16	109	430	1913

See footnotes at end of table.

TABLE 6.—*Bureau of Reclamation dams*—Continued

State and project	Name of dam	River	Type	Capacity	Height	Length	Volume	Year
Nevada-California:								
Truckee River storage	Boca	Little Truckee	Earth	41, 200	116	1, 629	911, 900	1939
New Mexico:								
Carlsbad	Alamogordo	Pecos	Earth and rockfill	156, 800	148	3, 084	1, 914, 900	1937
	Avalon [1]	do	Earth	7, 000	58	1, 025	202, 300	1891
	McMillan	do	do	38, 700	57	2, 114	234, 000	1894
New Mexico-Texas:								
Rio Grande	Caballo [1]	Rio Grande	Earth	345, 900	112	4, 558	1, 244, 200	1938
	Elephant Butte	do	Concrete gravity, power plant (1940).	[2] 2, 219, 000	301	1, 674	629, 500	1916
North Dakota:								
Heart Butte (Missouri River Basin).	Heart Butte	Heart River	Earth	450, 000	174	1, 850	1, 222, 000	1949
Dickinson (Missouri River Basin).	Dickinson	do	do	16, 500	69	2, 225	326, 000	(4)
Oklahoma:								
W. C. Austin	Altus [1]	Red, North Fork	Concrete gravity, masonry-faced.	[2] 151, 700	110	1, 112	70, 200	1945
Oregon:								
Baker	Thief Valley	Powder	Concrete slab-and-buttress	17, 400	70	390	6, 288	1932
Burnt River	Unity	Burnt	Earth, rock-faced	25, 800	83	675	253, 600	1938
Deschutes	Crane Prairie	Deschutes	Earth	55, 300	36	285	29, 700	1940
	Wickiup	do	do	180, 000	100	13, 860	1, 852, 000	1949
	Wickiup-East Dike	do	do		28	3, 420		1949
Umatilla	Cold Springs	Offstream	do	[2] 50, 000	117	3, 450	793, 400	1908
	McKay	McKay Creek	Earth, concrete-faced	[2] 73, 800	180	2, 700	2, 363, 800	1927
Vale	Agency Valley	Malheur, North Fork	Earth	59, 900	110	1, 850	645, 300	1935
	Warm Springs	Malheur, Middle Fork	Concrete arch	192, 400	106	469	19, 500	1919
Oregon-California:								
Klamath	Clear Lake	Lost	Earth	527, 000	39	840	63, 400	1910
	Gerber	Miller Creek	Concrete arch	[2] 94, 300	88	485	11, 900	1925
	Link River	Link	Concrete slab-and-buttress, lake outlet regulator.	[2] 873, 000	22	435	2, 200	1921
Oregon-Idaho:								
Owyhee	Owyhee [1]	Owyhee	Concrete arch-gravity	1, 120, 000	417	833	537, 500	1932
South Dakota:								
Angostura (Missouri River Basin).	Angostura	Cheyenne	Concrete gravity, embankment wing.	220, 000	187	1, 900	749, 600	1949
Belle Fourche	Belle Fourche	Owl Creek	Earth, concrete-faced	[2] 177, 500	122	6, 262	1, 783, 200	1911
Rapid Valley	Deerfield	Castle Creek	Earth	15, 700	133	825	607, 400	1947
Shadehill (Missouri River Basin).	Shadehill	Grand	do	467, 000	145	1, 900	3, 500, 000	(4)
Texas:								
Colorado River	Marshall Ford	Colorado (Texas)	Concrete gravity, embankment wings, power plant.	1, 951, 300	278	5, 093	3, 579, 000	1942

Utah:								
Hyrum	Hyrum [1]	Little Bear	Earth	18, 800	116	540	435, 600	1935
Moon Lake	Midview	Offstream	do	5, 800	54	663	138, 900	1937
	Moon Lake	Lake Fork, West Fork	do	[2] 35, 800	110	1, 108	513, 100	1938
Newton	Newton	Clarkson Creek	do	5, 500	101	4, 781	410, 000	1946
Ogden River	Pine View	Ogden	do	43, 600	103	480	267, 700	1937
Provo River	Deer Creek	Provo	do	152, 600	235	1, 304	2, 827, 900	1941
Scofield Dam	Scofield	Price	do	73, 000	125	575	202, 700	1946
Strawberry Valley	Strawberry	Strawberry	do	283, 000	79	488	117, 900	1913
Weber River	Echo	Weber	do	73, 900	158	1, 887	1, 539, 800	1931
Washington:								
Columbia Basin	Grand Coulee	Columbia	Concrete gravity, 2 power plants and pumping plant.	9, 517, 000	550	4, 173	10, 585, 000	1942
	South Coulee	Offstream	Earth	1, 484, 000	94	9, 800	1, 605, 000	1949
	North Coulee	do	do		145	1, 400	1, 228, 000	(4)
	Long Lake	do	do	62, 700	130	1, 900	1, 489, 000	1948
	O'Sullivan	Lower Crab Creek	do	606, 000	200	19, 000	9, 245, 000	1949
Okanogan	Conconully	Salmon Creek	Earth, hydraulic fill	[2] 13, 000	70	1, 000	359, 000	1910
	Salmon Lake	do	Earth	[2] 10, 500	42	1, 260	194, 900	1921
Yakima	Bumping Lake	Bumping	do	37, 300	45	3, 660	252, 600	1910
	Clear Creek	Tieton, North Fork	Concrete arch	5, 300	80	404	5, 800	1914
	Cle Elum	Cle Elum	Earth	529, 200	135	750	1, 411, 300	1933
	Kachess	Kachess	do	[2] 239, 000	114	1, 400	199, 600	1912
	Keechelus	Yakima	do	170, 500	103	6, 550	683, 500	1917
	Tieton	Tieton	Earth, semihydraulic fill	[2] 197, 000	235	920	2, 048, 600	1925
Wyoming:								
Boysen (Missouri River Basin)	Boysen	Big Horn	Earth, power plant	1, 493, 000	220	1, 000	1, 689, 000	(4)
Cheyenne (Missouri River Basin)	Keyhole	Belle Fourche	Earth	510, 000	165	3, 420	1, 300, 000	(4)
Eden	Big Sandy	Big Sandy Creek	do	65, 000	80	2, 300	840, 000	(4)
Kendrick	Alcova [1]	North Platte	do	190, 700	265	763	1, 635, 300	1938
	Seminoe	do	Concrete arch, power plant	[2] 1, 026, 000	295	530	210, 200	1939
Kortes Power (Missouri River Basin).	Kortes [3]	do	Concrete gravity, power plant	4, 800	240	440	147, 000	(4)
Riverton	Bull Lake	Bull Lake Creek	Earth	[2] 152, 000	81	3, 456	819, 600	1938
	Pilot Butte	Offstream	Earth, semihydraulic fill	[2] 31, 600	51	1, 300	135, 300	1926
Wyoming-Montana:								
Shoshone	Deaver	do	Earth	680	14	1, 300	30, 300	1918
	Ralston	do	do	1, 500	35	2, 200	24, 700	1908
	Buffalo Bill	Shoshone	Concrete arch, power plant	[2] 456, 600	325	200	82, 900	1910

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[1] Storage and diversion—dam classified according to its principal feature.

[2] Live storage—dead storage not evaluated.

[3] Power dam—water supply for generation of power.

[4] Under construction.

[5] Horsetooth Reservoir formed by 4 dams.

[6] Not available.

NOTES

Capacity: Storage dams—acre-feet of reservoir storage provided by highest controlled water surface; diversion dams—second-feet of diversion provided by canal headworks at dam.

Height: Storage dams—feet between lowest point in foundation and normal crest of dam; diversion dams—feet between original streambed and highest controlled water surface.

Length: Feet of barrier in dam and integral features constructed between natural abutments.

Volume: Cubic yards of all material in dam and its appurtenent features.

Year: Date original construction was completed. (Tabular data include supplemental construction.)

others were follow-ups in which the Bureau had arranged for exchange of technical data.

During the fiscal year, Bureau of Reclamation engineers participated in international conferences, including the United Nations Scientific Conference on the Conservation and Utilization of Resources at which three papers were presented, and the International Conference on Large Electric High-Tension Systems. Nine technical papers have been prepared for presentation at the International Congress on Large Dams to be held in India in January 1951.

OPERATION AND MAINTENANCE

Reclamation exists not only for the purpose of constructing dams and power plants and creating far-flung irrigation systems, but for the service that these facilities provide. This service is an important factor in the creation of irrigation farms for settlement by veterans and others, homes for farm families, sound agricultural communities, and stable agricultural foundations for related business and commercial enterprises throughout the West.

In 1949, through the Bureau of Reclamation's operation and maintenance activities, irrigation service was supplied to 91,000 farms with a total farm population of 354,000. A farm population in excess of 246,000 was reported for the 64,000 farms on regular Reclamation projects and a population of about 108,000 for the 27,000 farms receiving water from Reclamation under Warren Act or special contracts. With the inclusion of units of less than 5 acres, the total number for 1949 was nearly 100,000 farms.

Including the approximately 1,500,000 population reported for towns located on or adjacent to the irrigation projects, the Reclamation area population now totals about 1,850,000, an increase of roughly a quarter of a million from the 1948 estimate. The estimates are exclusive of Central Valley project in California.

In addition to the above, Reclamation service is provided to a large number of people in distant cities, towns and rural areas who receive electric energy from hydroelectric plants on Reclamation projects, and others benefit directly from flood control and through use of recreational facilities created by storage reservoirs.

Operation and maintenance of the 65 projects, or divisions of projects, completed by the Bureau of Reclamation, including the use of water, maintenance of irrigation systems, production of crops and livestock, and the general welfare of the water users, constitute "service" matters of primary concern to every Reclamation employee.

Progress was continued during fiscal year 1950 on one of the fundamental service jobs of Reclamation, namely, to "keep the water running down the ditch." This is sometimes a complicated matter involving stream flow and runoff forecasts, regulation and operation of storage reservoirs and distribution systems, maintenance of all structures and distribution facilities, measurement and delivery of water, drainage where necessary, and control of waterweeds. The task is becoming even more complicated on multipurpose, basin-wide projects such as in the Central Valley of California and in the Columbia and Missouri River Basins.

Other operation and maintenance activities on which progress continued include negotiation and approval of amendatory and new repayment and water service contracts, rehabilitation and betterment of older existing projects, sprinkler irrigation studies, opening of additional public land to settlement, operation of development farms to provide assistance to settlers and others, lower cost canal lining investigations, and soil and moisture conservation operations. The end objective of all the operation and maintenance activities is the adequate and proper development of land through irrigation, and its use by farm families.

EXTENSION OF IRRIGATION SERVICE

Irrigation facilities were extended in 1949 to the point where irrigation service could be provided for 5,678,512 acres, an increase of 298,497 acres over that of the previous crop year. Total acreage irrigated was 4,820,589, an increase of 261,834 over 1948. The difference between the acreage for which irrigation facilities have been provided and the acreage irrigated is due principally to the need for allowing land to fallow for a season, the need for farm ditches on some new farms, clearing or leveling, idle land involved in settlement of estates, rights of-way, and other factors.

Projects reporting the principal amount of increase in acreage irrigated, with the farms and acreages furnished a full or supplemental water supply for the first time during 1949 include the following:

	Irrigated farms	Irrigated acres
Minidoka project, Idaho	21	680
Boise project, Black Canyon irrigation district, Idaho	142	5,738
Rathdrum Prairie project, Idaho	123	916
Columbia Basin, Pasco unit, Washington	49	2,130
Yakima project, Roza division. Washington	77	1,182
Deschutes project, North unit, Oregon	89	13,252
Klamath project. Oregon-California		5,420
Central Valley project, California		101,431
All-American Canal system, Coachella division, California	64	4,397
Gila project, Yuma Mesa division, Arizona	8	200
Mancos project, Colorado		6,292
Tucumcari project, New Mexico	66	6,440
W. C. Austin project, Oklahoma	54	18,408
Riverton project, Wyoming	10	1,198
Shoshone project, Wyoming	15	1,682
Kendrick project, Wyoming	4	[1] 1,373
Mirage Flats, project, Nebraska	5	[1] 994
Total	727	171,733

[1] Includes acreage added to existing farms.

TABLE 7.—*Projects in operation—Irrigation and crop value data for the calendar year 1949*

State, project, and subdivision	Projects entirely constructed by the Bureau							Projects furnished supplemental storage water from works constructed by the Bureau					Special and Warren Act contractors receiving water from Bureau constructed works				
	Irrigable area [1]	Irrigated area	Land subject to construction charges			Temporarily suspended land [2]		Irrigable area [1]	Irrigated area	Net area in cultivation	Crop values		Irrigable area [1]	Irrigated area	Net area in cultivation	Crop values	
			Net area in cultivation	Crop values		Net area in cultivation	Total crop values				Total	Per acre				Total	Per acre
				Total	Per acre												
REGION 1																	
Idaho																	
Minidoka:																	
	Acres	*Acres*	*Acres*			*Acres*		*Acres*	*Acres*	*Acres*			*Acres*	*Acres*	*Acres*		
American Falls reservoir district No. 2	94, 836	83, 994	83, 994	$5, 035, 821	$59. 95												
Burley irrigation district	47, 937	44, 329	44, 329	3, 993, 603	90. 09												
Fremont-Madison irrigation district								112, 000	100, 889	108, 644	$5,046,765	$46. 45					
Minidoka irrigation district	71, 882	62, 545	62, 545	5, 047, 255	80. 70												
Total—Minidoka project	214, 655	190, 868	190, 868	14, 076, 679	73. 75			112, 000	100, 889	108, 644	5, 046, 765	46. 45	722, 453	682, 939	682, 939	$47,593,500	$69. 69
Rathdrum Prairie:																	
Hayden Lake unit [3]								1, 050	830	830	48, 380	58. 29					
Post Falls unit [3] [4]	3, 109	2, 269	2, 754	125, 366	45. 52												
Idaho-Oregon																	
Boise:																	
Big Bend irrigation district (Oregon)	1, 721	1, 489	1, 489	86, 151	57. 86												
Black Canyon irrigation district (Notus)	6, 872	6, 570	6, 598	948, 592	143. 77												
Black Canyon irrigation district (Payette)	32, 642	29, 249	29, 717	1, 701, 817	57. 27												
Boise-Kuna irrigation district	48, 488	45, 005	45, 283	3, 490, 709	77. 09												
Nampa-Meridian irrigation district	40, 262	34, 920	35, 015	2, 760, 449	78. 84												
New York irrigation district	17, 826	14, 553	14, 710	623, 024	42. 35												

Settlers irrigation district	518															
Wilder irrigation district	56,472	50,037	50,055	5,849,315	116.86											
Total—Boise project	204,801	181,823	182,867	15,460,057	84.54								125,303	116,900	116,900	12,605,200	107.83
Montana																
Bitter Root [3]	16,665	16,170	16,482	510,878	31.00											
Frenchtown	4,935	2,575	2,949	134,512	45.61											
Missoula Valley [4]								977	258	414	9,340	22.56				
Oregon																
Baker								7,312	7,255	7,255	261,355	36.02				
Burnt River								15,291	15,260	15,260	446,340	29.25				
Deschutes:																
Central Oregon irrigation district								44,589	42,531	42,531	5,355,880	125.93				
North unit	50,000	39,967	45,067	5,037,085	117.69											
Umatilla:																
East division	10,911	7,032	6,653	247,150	37.15	379	$13,190									
West division	7,620	5,054	5,234	163,411	31.22	0	0									
South division:																
Stanfield irrigation district								6,000	5,341	5,435	311,419	57.30				
Westland irrigation district								8,028	4,830	4,716	218,120	46.25				
Total—Umatilla project	18,531	12,086	11,887	410,561	34.54	379	13,190	14,028	10,171	10,151	529,539	52.17	1,082	961	922	59,831	64.89
Vale	32,000	30,070	30,070	2,194,767	72.99											
Oregon-Idaho																
Owyhee:																
Advancement irrigation district	701	602	620	72,777	117.38											
Bench irrigation district	2,311	2,216	2,221	442,959	199.44											
Crystal irrigation district	1,263	1,125	1,125	218,295	194.04											
Gem irrigation district (Idaho)	30,448	29,413	29,660	3,222,900	108.66											
Ontario-Nyssa irrigation district	5,873	5,218	5,287	895,684	169.41											
Owyhee irrigation district	56,199	50,645	50,798	4,983,162	98.10											
Payette-Oregon Slope irrigation district	4,617	4,332	4,333	1,008,003	232.63											
Slide irrigation district	1,092	1,060	1,078	126,523	117.37											
Total—Owyhee project	102,504	94,611	95,122	10,970,303	115.33								13,800	13,110	13,110	2,543,083	193.98

See footnotes at end of table.

TABLE 7.—*Projects in operation—Irrigation and crop value data for the calendar year 1949*—Continued

State, project, and subdivision	Projects entirely constructed by the Bureau							Projects furnished supplemental storage water from works constructed by the Bureau					Special and Warren Act contractors receiving water from Bureau-constructed works				
	Irrigable area [1]	Irrigated area	Land subject to construction charges			Temporarily suspended land [2]											
			Net area in cultivation	Crop values		Net area in cultivation	Total crop values	Irrigable area [1]	Irrigated area	Net area in cultivation	Crop values		Irrigable area [1]	Irrigated area	Net area in cultivation	Crop values	
				Total	Per acre						Total	Per acre				Total	Per acre
REGION 1—Continued																	
Washington																	
Columbia Basin:	*Acres*	*Acres*	*Acres*			*Acres*		*Acres*	*Acres*	*Acres*			*Acres*	*Acres*	*Acres*		
East Columbia Basin irrigation district	80	77	77	$16,067	$208.66												
Quincy-Columbia Basin irrigation district	111	80	85	8,501	100.01												
South Columbia Basin irrigation district	5,552	2,249	2,249	219,869	97.76												
Total—Columbia Basin project	5,743	2,406	2,411	244,437	101.38												
Okanogan	5,321	3,824	3,824	723,687	189.25												
Yakima:																	
Kittitas division	59,610	54,238	54,477	2,944,494	54.05	0	0										
Roza division	44,712	38,643	38,583	6,294,856	163.15	56	$1,146										
Sunnyside division	103,579	81,968	83,209	11,231,360	134.98	411	20,749										
Tieton division	27,271	24,640	24,725	6,142,041	248.41	0	0										
Total—Yakima project	235,172	199,489	200,994	26,612,751	132.41	467	21,895						191,400	162,702	163,458	$21,770,672	$133.19
Total—Region 1	893,436	776,158	785,295	76,501,083	97.42	846	35,085	195,247	177,194	185,085	$11,697,599	$63.20	1,054,038	976,612	977,329	84,572,286	86.53
REGION 2																	
California																	
Central Valley													438,864	304,782	322,870	48,232,869	149.39
Orland	19,440	16,706	16,706	1,504,794	90.08												

Oregon-California																	
Klamath:																	
Main division (Oregon)	41, 102	32, 906	32, 047	3, 665, 127	114. 37	1, 157	74, 900										
Tule Lake division (California)	44, 327	42, 518	43, 475	6, 325, 455	145. 50	80	5, 494										
Total—Klamath project	85, 429	75, 424	75, 522	9, 990, 582	132. 29	1, 237	80, 394						85, 933	74, 484	74, 484	5, 366, 288	72. 05
Total—Region 2	104, 869	92, 130	92, 228	11, 495, 376	124. 64	1, 237	80, 394						524, 797	379, 266	397, 354	53, 599, 157	134. 89
REGION 3																	
Arizona																	
Gila: Yuma Mesa division:																	
Yuma Mesa	20, 251	6, 308	6, 840	735, 817	107. 58												
North Gila Valley	7, 118	5, 689	5, 689	684, 847	120. 38												
Total—Gila project	27, 369	11, 997	12, 529	1, 420, 664	113. 39								960	895	895	111, 885	125. 01
Salt River	243, 125	219, 039	225, 621	30, 807, 031	136. 54								97, 814	81, 607	81, 607	13, 759, 171	168. 60
Arizona-California																	
Yuma:																	
Reservation division:																	
Indian lands (California)	7, 734	3, 799	3, 799	318, 569	83. 86	267	38, 220										
Bard irrigation district (California)	6, 890	5, 668	6, 059	520, 413	85. 89	0	0										
Valley division (Arizona)	50, 390	46, 711	46, 527	13, 485, 178	289. 84	0	0										
Yuma Auxiliary (Mesa) (Arizona)	3, 607	2, 086	2, 086	888, 728	426. 04	0	0										
Total—Yuma project	68, 621	58, 264	58, 471	15, 212, 888	260. 18	267	38, 220										
California																	
All-American Canal:																	
Imperial irrigation district													523, 000	420, 000	440, 000	72, 638, 099	165. 09
Coachella division [5]	24, 836	24, 483	24, 483	16, 103, 356	657. 74												
Total—Region 3	363, 951	313, 783	321, 104	63, 543, 939	197. 89	267	38, 220						621, 774	502, 502	522, 502	86, 509, 155	165. 57
REGION 4																	
Colorado																	
Fruitgrowers Dam								2, 662	2, 134	2, 134	231, 537	108. 50					

See footnotes at end of table.

TABLE 7.—*Projects in operation—Irrigation and crop value data for the calendar year 1949*—Continued

State, project, and subdivision	Projects entirely constructed by the Bureau							Projects furnished supplemental storage water from works constructed by the Bureau					Special and Warren Act contractors receiving water from Bureau-constructed works				
	Irrigable area [1]	Irrigated area	Land subject to construction charges			Temporarily suspended land [2]		Irrigable area [1]	Irrigated area	Net area in cultivation	Crop values		Irrigable area [1]	Irrigated area	Net area in cultivation	Crop values	
			Net area in cultivation	Crop values		Net area in cultivation	Total crop values				Total	Per acre				Total	Per acre
				Total	Per acre												
REGION 4—Continued																	
Colorado—Continued																	
Grand Valley:	*Acres*	*Acres*	*Acres*			*Acres*		*Acres*	*Acres*	*Acres*			*Acres*	*Acres*	*Acres*		
Gravity division	30,444	20,510	20,986	$1,251,658	$59.64												
Orchard Mesa irrigation district [3]	10,027	7,910	7,910	897,657	113.48												
Total—Grand Valley project	40,471	28,420	28,896	2,149,315	74.38								7,950	7,649	7,649	$820,921	$107.32
Mancos [4]								7,970	6,292	6,457	$208,248	$32.25					
Pine River								33,969	31,375	31,866	768,722	24.12	826	791	791	16,205	20.49
Uncompahgre	92,190	67,153	64,994	3,693,228	56.82	2,159	$69,374						6,029	5,642	5,642	253,930	45.01
Idaho																	
Preston Bench [3]								4,318	4,144	4,144	309,076	74.58					
Nevada																	
Humboldt								39,131	25,028	25,028	1,520,841	60.77					
Newlands	69,736	52,077	50,432	2,750,722	54.54	1,674	33,480										
Truckee River storage								28,804	23,235	23,235	1,494,467	64.32					
Utah																	
Hyrum								6,260	5,488	5,603	319,526	57.03					
Moon Lake								72,608	58,447	58,834	1,103,697	18.76					
Newton [4]								2,225	2,020	2,230	130,759	58.64					
Ogden River								22,822	15,864	15,864	1,335,462	84.18					
Provo River: Deer Creek division								46,365	37,706	39,120	3,447,329	88.12					

Sanpete:																	
Ephraim division								6,700	5,835	6,095	176,035	28.88					
Spring City division								6,017	5,056	5,556	184,374	33.18					
Total—Sanpete project								12,717	10,891	11,651	360,409	30.93					
Scofield [4]								15,609	14,544	15,009	781,576	52.07					
Strawberry Valley:																	
Highline division	18,372	16,302	16,742	741,590	44.30												
Spanish Fork division	13,817	13,194	13,364	830,753	62.16												
Springville-Mapleton irrigation district	8,975	8,253	8,352	561,101	67.18												
Total—Strawberry Valley project	41,164	37,749	38,458	2,133,444	55.47								5,012	4,778	4,830	285,509	59.11
Weber River (Salt Lake Basin)								91,730	90,701	90,801	9,394,389	103.46					
Total—Region 4	243,561	185,399	182,780	10,726,709	58.69	3,833	102,854	387,190	327,869	331,976	21,406,038	64.48	19,817	18,860	18,912	1,376,565	72.79
REGION 5																	
Oklahoma																	
W. C. Austin	48,000	35,841	36,255	3,087,440	85.16												
New Mexico																	
Carlsbad	25,055	20,988	20,988	3,039,814	144.84												
Tucumcari	35,276	22,510	22,961	1,177,884	51.30												
New Mexico-Texas																	
Rio Grande:																	
Elephant Butte irrigation district (New Mexico)	88,000	91,701	85,955	21,216,728	246.84	5,968	939,155										
El Paso County water improvement district No. 1 (Texas)	67,000	67,342	64,120	17,163,799	267.68	3,555	789,898										
Total—Rio Grande project [6]	155,000	159,043	150,075	38,380,527	255.74	9,523	1,729,053						20,483	17,305	17,305	4,740,921	273.96
Texas																	
Balmorhea [4]								10,528	7,411	7,411	795,723	107.37					
Total—Region 5	263,331	238,382	230,279	45,685,665	198.39	9,523	1,729,053	10,528	7,411	7,411	795,723	107.37	20,483	17,305	17,305	4,740,921	273.96

See footnotes at end of table.

TABLE 7.—*Projects in operation—Irrigation and crop value data for the calendar year 1949*—Continued

State, project, and subdivision	Projects entirely constructed by the Bureau							Projects furnished supplemental storage water from works constructed by the Bureau					Special and Warren Act contractors receiving water from Bureau-constructed works				
	Irrigable area [1]	Irrigated area	Land subject to construction charges			Temporarily suspended land [2]		Irrigable area [1]	Irrigated area	Net area in cultivation	Crop values		Irrigable area [1]	Irrigated area	Net area in cultivation	Crop values	
			Net area in cultivation	Crop values		Net area in cultivation	Total crop values				Total	Per acre				Total	Per acre
				Total	Per acre												
REGION 6																	
Montana																	
Buffalo Rapids:	*Acres*	*Acres*	*Acres*			*Acres*		*Acres*	*Acres*	*Acres*			*Acres*	*Acres*	*Acres*		
First division	15,333	14,151	14,151	$728,927	$51.51	------	------	------	------	------	------	------	------	------	------	------	------
Second division	8,100	5,985	6,749	202,186	29.96	------	------	------	------	------	------	------	------	------	------	------	------
Total—Buffalo Rapids project [4]	23,433	20,136	20,900	931,113	44.55	------	------	------	------	------	------	------	------	------	------	------	------
Dodson pumping unit (Milk River) [4]	1,179	1,179	1,179	67,179	56.98	------	------	------	------	------	------	------	------	------	------	------	------
Huntley	32,508	24,385	16,856	1,212,043	71.91	7,861	$283,400	------	------	------	------	------	------	------	------	------	------
Intake [4]	881	403	403	23,563	58.47	------	------	------	------	------	------	------	------	------	------	------	------
Milk River:																	
Chinook division	43,484	33,044	33,220	1,816,943	54.69	0	0	------	------	------	------	------	------	------	------	------	------
Glasgow division	19,407	9,787	10,993	410,073	37.30	954	25,620	------	------	------	------	------	------	------	------	------	------
Malta division	53,733	23,386	15,281	698,060	45.68	8,296	133,930	------	------	------	------	------	------	------	------	------	------
Pump lands	9,198	8,970	9,198	464,200	50.47	0	0	------	------	------	------	------	------	------	------	------	------
Total—Milk River project	125,822	75,187	68,692	3,389,276	49.34	9,250	159,550	------	------	------	------	------	------	------	------	------	------
Sun River:																	
Fort Shaw division	13,902	7,533	8,352	228,335	27.34	156	2,774	------	------	------	------	------	------	------	------	------	------
Greenfields division	83,402	68,967	77,352	2,373,641	30.69	0	0	------	------	------	------	------	------	------	------	------	------
Total—Sun River project	97,304	76,500	85,704	2,601,976	30.36	156	2,774	------	------	------	------	------	------	------	------	------	------

Montana-North Dakota																	
Lower Yellowstone:																	
District No. 1 (Montana)	37,272	32,885	32,885	1,983,731	60.32												
District No. 2 (North Dakota)	19,928	16,185	16,185	875,435	54.09												
Total—Lower Yellowstone project	57,200	49,070	49,070	2,859,166	58.27												
North Dakota																	
Buford-Trenton [4]	7,915	7,578	7,670	321,093	41.86												
South Dakota																	
Belle Fourche	59,129	51,168	52,409	2,095,481	39.98												
Rapid Valley [4]								6,498	5,974	5,974	$175,974	$29.46					
Wyoming																	
Riverton	48,741	41,272	41,919	2,010,974	47.97								1,802	1,727	1,727	$82,031	$47.50
Shoshone:																	
Frannie division	20,170	10,786	10,861	385,358	35.48	130	$2,283										
Garland division	41,627	34,003	33,064	1,674,307	50.64	939	14,517										
Heart Mountain division	25,213	8,767	8,767	337,429	38.49	0	0										
Willwood division	11,426	10,356	10,596	536,652	50.65	0	0										
Total—Shoshone project	98,436	63,912	63,288	2,933,746	46.36	1,069	16,800										
Total—Region 6	552,548	410,790	408,090	18,445,610	45.20	18,336	462,524	6,498	5,974	5,974	175,974	29.46	1,802	1,727	1,727	82,031	47.50
REGION 7																	
Nebraska																	
Mirage Flats [4]	11,604	11,163	11,163	411,001	36.82												
Nebraska-Wyoming																	
North Platte:																	
Gering-Fort Laramie irrigation district	55,126	51,187	50,243	3,364,199	66.96	944	25,677										
Goshen irrigation district (Wyoming)	52,487	44,351	42,914	2,692,810	62.75	1,437	23,281										
Northport irrigation district	13,615	12,167	10,733	444,032	41.37	1,434	5,353										
Pathfinder irrigation district	112,369	89,758	73,772	3,993,601	54.13	15,986	333,801										
Total—North Platte project	233,597	197,463	177,662	10,494,64	259.07	19,801	388,112						139,504	132,209	132,209	8,101,130	61.28

See footnotes at end of table.

TABLE 7.—*Projects in operation—Irrigation and crop value data for the calendar year 1949*—Continued

State, project, and subdivision	Projects entirely constructed by the Bureau							Projects furnished supplemental storage water from works constructed by the Bureau					Special and Warren Act contractors receiving water from Bureau-constructed works				
	Irrigable area [1]	Irrigated area	Land subject to construction charges			Temporarily suspended land [2]		Irrigable area [1]	Irrigated area	Net area in cultivation	Crop values		Irrigable area [1]	Irrigated area	Net area in cultivation	Crop values	
			Net area in cultivation	Crop values		Net area in cultivation	Total crop values				Total	Per acre				Total	Per acre
				Total	Per acre												
REGION 7—Continued																	
Wyoming																	
	Acres	*Acres*	*Acres*			*Acres*		*Acres*	*Acres*	*Acres*			*Acres*	*Acres*	*Acres*		
Kendrick	8, 462	5, 197	5, 197	$123, 580	$23. 78												
Total—Region 7	253, 663	213, 823	194, 022	11, 029, 223	56. 85	19, 801	$388, 112						139, 504	132, 209	132, 209	$8, 101, 130	$61. 28
SUMMARY																	
Region 1	893, 436	776, 158	785, 295	76, 501, 083	97. 42	846	35, 085	195, 247	177, 194	185, 085	$11,697,599	$63. 20	1,054,038	976, 612	977, 329	84, 572, 286	86. 53
Region 2	104, 869	92, 130	92, 228	11, 495, 376	124. 64	1, 237	80, 394	0	0	0	0	0	524, 797	379, 266	397, 354	53, 599, 157	134. 89
Region 3	363, 951	313, 783	321, 104	63, 543, 939	197. 89	267	38, 220	0	0	0	0	0	621, 774	502, 502	522, 502	86, 509, 155	165. 57
Region 4	243, 561	185, 399	182, 780	10, 726, 709	58. 69	3, 833	102, 854	387, 190	327, 869	331, 976	21,406,038	64. 48	19, 817	18, 860	18, 912	1, 376, 565	72. 79
Region 5	263, 331	238, 382	230, 279	45, 685, 665	198. 39	9, 523	1, 729, 053	10, 528	7, 411	7, 411	795, 723	107. 37	20, 483	17, 305	17, 305	4, 740, 921	273. 96
Region 6	552, 548	410, 790	408, 090	18, 445, 610	45. 20	18, 336	462. 524	6, 498	5, 974	5, 974	175, 974	29. 46	1, 802	1, 727	1, 727	82, 031	47. 50
Region 7	253, 663	213, 823	194, 022	11, 029, 223	56. 85	19, 801	388, 112	0	0	0	0	0	139, 504	132, 209	132, 209	8, 101, 130	61. 28
Total	2, 675, 359	2, 230, 465	2, 213, 798	237, 427, 605	107. 25	53, 843	2. 836, 242	599, 463	518. 448	530. 446	34,075, 334	64. 242	382,2152	028,4812	067,3382	38.981,245	115. 60
Total—Regular projects	2, 675, 359	2, 230, 465	2, 213, 798	237, 427, 605	107. 25												
Total—Storage projects	599, 463	518, 448	530, 446	34, 075, 334	64. 24												
Total—Special and Warren Act contractors	2, 382, 215	2, 028, 481	2, 067, 338	238, 981, 245	115. 60												
Additional areas reported:																	
Temporarily suspended			53, 843	2, 836, 242	52. 68												
Leased areas		43, 195	50, 809	3, 008, 582	59. 21												
Total	5, 657, 037	4, 820, 589	4, 916, 234	516, 329, 008	105. 03												

Additional irrigable lands, no crop details reported [7]	21,475																
Grand total	5,678,512	4,820,589	4,916,234	516,329,008	105.03												
Grand total, 1948	5,380,015	4,558,755	4,699,734	534,623,541	113.76												
Increase and decrease, 1948–49 total	+298,497	+261,834	+216,500	−18,294,533	−8.73												

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[1] Area for which the Bureau is prepared to supply water.
[2] Generally part of irrigable area but not subject to construction charges until reclaimed.
[3] Private project reconstructed with Government funds.
[4] Water conservation and utilization project.
[5] Includes 18,811 acres irrigated from privately constructed facilities.
[6] Although there are 178,018 acres that can be irrigated within project limits, the area for which there is considered to be a safe and reliable water supply is 155,000 acres.
[7] Includes Arnold and Lone Pine irrigation districts, Deschutes project, and Indian reservation lands on Pine River project.

NOTE.—**Per acre value based on net area in cultivation.**

The remaining increase of 90,101 acres irrigated, not listed by projects, represents lands on Reclamation projects which temporarily received a water supply from private wells, and scattered tracts of land on a number of projects that had a previous irrigation history, but were not irrigated in 1948. An estimated additional 110,000 acres will be irrigated for the first time during 1950 with project water.

Operation and Maintenance of Irrigation Systems

In order to supply Reclamation area farmers with irrigation water for crop production, activities on operating projects continued to stress, as the first order of business, the storage, regulation, and distribution of irrigation water supplies, and the maintenance of structures and distribution systems. As a result, crops were matured profitably on all operating projects during the calendar year 1949, despite some water shortages which occurred again in the Southwest. On some projects where surface water was not adequate, ground water was pumped to supplement supplies.

The Bureau of Reclamation operates and maintains directly 24 projects or divisions of projects, while 41 projects or divisions of projects are now operated by water-users organizations under only general supervision of the Bureau. In accordance with established congressional and departmental policy providing for transfer of completed projects to water users for operation and maintenance, the Carlsbad project was so transferred during the fiscal year.

Progress was made on investigations of and improvements in serious drainage conditions, and in water-conservation programs, including control of carriage losses, sprinkler-irrigation investigations, education for better farm-irrigation practices, waterweeds control, and reuse of return flows, all aimed at fuller utilization of water resources.

One major break in a distribution system occurred early in March 1950 when mountain landslides crushed a portion of a tunnel forming part of the main canal of Grand Valley project, Colorado. Although first estimates for repairs indicated that serious delay might be suffered in project water delivery, expeditious handling and close teamwork resulted in completed construction of a new tunnel bore around the collapsed section within 2 months, and water delivery to project farmers early in May, practically on schedule. This achievement was accomplished through cooperative effort by the Chief Engineer, the Regional Director, the project operation and maintenance forces, and the contractor, whose forces worked consistently around the clock to get the job done.

CROP PRODUCTION

For the fourth consecutive year, crop production on farms receiving Federal Reclamation water was in excess of one-half billion dollars. For the fifth successive year, the value of crops grown exceeded $100 an acre. The 1949 valuation of $516,329,008 compared with a record high of $555,420,804 established in 1947 and $534,623,541 in 1948. Crop returns in 1949 averaged $105.03 an acre while the previous year average was $113.76 an acre. Highest average return per acre was $121.95 in 1947. Highest 1949 per acre crop value was reported for the Coachella Valley, Calif., which receives water from Coachella division, All-American Canal system. Including 1949 production, the cumulative value of crops grown since irrigation water was first supplied from Reclamation projects in 1906 totals $6,583,570,000.

Vegetable and truck crops, a large portion of which were grown on projects in the Southwest that supply the Nation with fresh vegetables during the off-season months, accounted for about 29 percent of the 1949 value; and another 29 percent came from hay, forage, and grain crops, consumed largely by livestock in the producing areas or in feed lots near west coast cities.

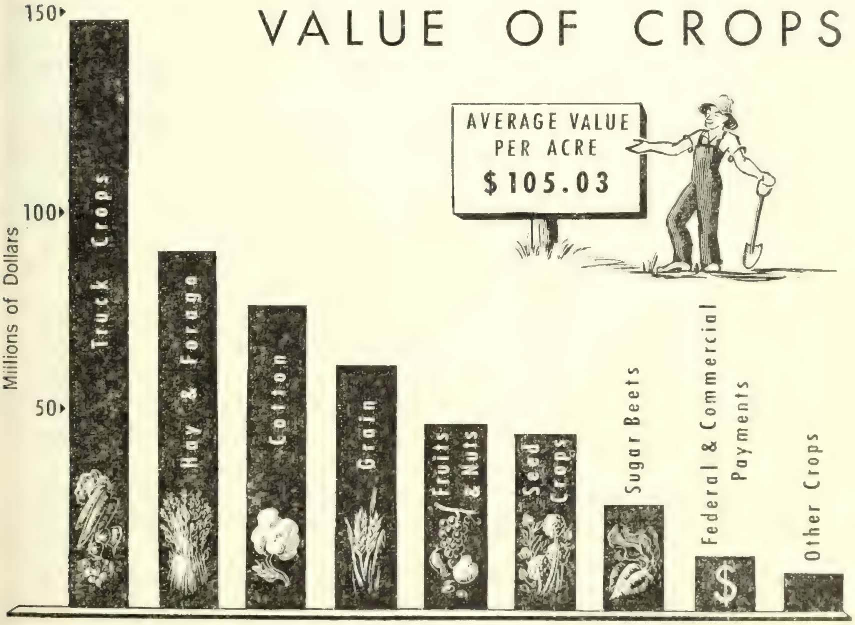

TABLE 8.—*Cumulative crop values, 1906–49* [1]

Year	Federal irrigation projects [2]					Warren act lands and special contractors					Entire area				
	Irrigable acreage	Irrigated acreage	Net area in cultivation	Total crop value		Irrigable acreage	Irrigated acreage	Net area in cultivation	Total crop value		Irrigable acreage	Irrigated acreage	Net area in cultivation	Total crop value	
				For year	Cumulative total				For year	Cumulative total				For year	Cumulative total
1906	39,300	[3] 22,300	[3] 20,100	[3] $244,900							39,300	[3] 22,300	[3] 20,100	[3] $244,900	
1907	266,300	[3] 187,628	[3] 169,000	[3] 4,760,460	$5,005,360						266,300	[3] 187,628	[3] 169,000	[3] 4,760,460	$5,005,360
1908	488,942	[3] 289,549	[3] 260,500	[3] 7,635,888	12,641,248						488,942	[3] 289,549	[3] 260,500	[3] 7,635,888	12,641,248
1909	730,601	410,628	410,628	11,920,663	24,561,911						730,601	410,628	369,500	11,920,663	24,561,911
1910	917,751	473,423	473,423	12,974,639	37,536,550						917,751	473,423	413,000	12,974,639	37,536,550
1911	1,042,609	564,681	564,681	13,121,224	50,657,774						1,042,609	564,681	470,100	13,121,224	50,657,774
1912	1,205,236	618,680	641,397	14,479,368	65,137,142						1,205,236	618,680	540,000	14,479,368	65,137,142
1913	1,255,381	699,183	642,216	15,732,215	80,869,357						1,255,381	699,183	637,227	15,732,215	80,869,357
1914	1,240,875	761,271	703,424	16,475,517	97,344,874						1,240,875	761,271	703,424	16,475,517	97,344,874
1915	1,472,772	856,778	757,613	18,164,452	115,509,326						1,472,772	856,778	760,035	18,164,452	115,509,326
1916	1,405,452	922,821	858,291	32,815,972	148,325,298						1,405,452	922,821	858,291	32,815,972	148,325,298
1917	1,599,525	1,057,513	966,784	56,462,313	204,787,611						1,599,525	1,057,513	966,784	56,462,313	204,787,611
1918	1,732,374	1,141,516	1,051,193	66,821,396	271,609,007	951,987	[3] 501,100	[3] 481,600	[3] $35,000,000		2,684,361	[3] 1,642,616	[3] 1,532,793	[3] 101,821,396	306,609,007
1919	1,636,159	1,187,255	1,113,469	88,974,137	360,583,144	1,011,815	916,313	880,613	64,004,750	$99,004,750	2,647,974	2,103,568	1,994,082	152,978,887	459,587,894
1920	1,661,960	1,223,480	1,153,820	66,171,650	426,754,794	1,183,292	981,940	950,890	47,505,770	146,510,520	2,845,252	2,205,420	2,104,710	113,677,420	573,265,314
1921	1,674,100	1,227,500	1,157,900	49,620,300	476,375,094	1,146,810	1,001,250	969,550	44,906,130	191,416,650	2,820,910	2,228,750	2,127,450	94,526,430	667,791,744
1922	1,692,700	1,202,130	1,169,100	50,360,850	526,735,944	1,101,700	983,290	951,270	33,240,840	224,657,490	2,794,400	2,185,420	2,120,370	83,601,690	751,393,434
1923	1,718,400	1,213,700	1,179,870	65,046,300	591,782,244	1,231,400	1,051,380	993,040	37,557,860	262,215,350	2,949,800	2,265,080	2,172,910	102,604,160	853,997,594
1924	1,805,730	1,290,890	1,216,610	66,488,560	658,270,804	1,237,885	930,670	889,460	43,237,470	305,452,820	3,043,615	2,221,560	2,106,070	109,726,030	963,723,624
1925	1,802,970	1,320,300	1,242,750	77,608,880	735,879,684	1,340,000	1,019,170	951,250	53,655,850	359,108,670	3,142,970	2,339,470	2,194,000	131,264,730	1,094,988,354
1926	1,844,550	1,411,020	1,361,470	60,664,900	796,554,584	1,329,020	1,097,190	949,590	49,750,040	408,858,710	3,173,570	2,508,210	2,278,400	110,414,940	1,205,403,294
1927	1,956,910	1,378,990	1,431,560	72,047,200	868,591,784	1,482,950	1,148,115	1,072,486	61,160,010	470,018,720	3,439,860	2,527,105	2,399,296	133,207,210	1,338,610,504
1928	1,882,930	1,442,080	1,489,240	81,077,750	949,669,534	1,490,735	1,235,020	1,192,030	62,495,320	532,514,040	3,373,665	2,677,100	2,577,590	143,573,070	1,482,183,574
1929	1,922,330	1,483,900	1,512,250	88,459,390	1,038,128,924	1,480,040	1,234,230	1,192,990	72,720,490	605,234,530	3,402,370	2,718,130	2,613,060	161,179,880	1,643,363,454
1930	1,993,390	1,504,810	1,550,967	65,007,270	1,103,136,194	1,640,722	1,286,046	1,254,493	54,654,550	659,889,080	3,634,112	2,790,856	2,721,590	119,661,820	1,763,025,274
1931	2,027,264	1,552,718	1,520,354	40,554,037	1,143,690,231	1,588,972	1,293,889	1,251,830	33,406,340	693,295,420	3,616,236	2,846,607	2,714,395	73,960,377	1,836,985,651
1932	2,039,074	1,555,144	1,578,880	31,531,162	1,175,221,393	1,512,405	1,214,461	1,196,400	18,627,219	711,922,639	3,551,479	2,769,605	2,702,720	50,158,381	1,887,144,032
1933	2,025,508	1,589,770	1,598,702	48,765,863	1,223,987,256	1,514,201	1,239,017	1,199,113	35,425,870	747,348,509	3,539,709	2,828,787	2,797,815	84,191,733	1,971,335,765
1934	1,986,268	1,552,124	1,527,104	60,928,969	1,284,916,225	1,508,377	1,285,081	1,229,594	40,014,745	787,363,254	3,494,645	2,837,205	2,693,999	100,943,714	2,072,279,479
1935	2,113,506	1,640,936	1,604,166	63,601,663	1,348,517,888	1,500,589	1,294,680	1,256,970	43,179,631	830,542,885	3,614,095	2,935,616	2,861,136	106,781,294	2,179,060,773
1936	2,166,409	1,702,192	1,629,174	78,902,818	1,427,420,706	1,527,008	1,335,995	1,272,745	57,599,662	888,142,547	3,693,417	3,038,187	2,901,919	136,502,480	2,315,563,253
1937	2,194,830	1,725,463	1,700,969	72,893,649	1,500,314,355	1,571,382	1,389,338	1,333,800	45,764,623	933,907,170	3,766,212	3,114,801	3,034,769	118,658,272	2,434,221,525
1938	2,275,882	1,777,584	1,764,363	67,859,804	1,568,174,159	1,507,051	1,329,115	1,276,332	45,603,656	979,510,826	3,782,933	3,106,699	3,040,695	113,463,460	2,547,684,985
1939	2,492,740	1,922,868	1,903,269	73,769,654	1,641,943,813	1,396,800	1,218,108	1,174,803	40,313,140	1,019,823,966	3,889,540	3,140,976	3,078,072	114,082,794	2,661,767,779
1940	2,780,811	2,152,808	2,138,927	80,098,196	1,722,042,009	1,399,057	1,238,262	1,177,103	37,690,481	1,057,514,447	4,179,868	3,391,070	3,316,030	117,788,677	2,779,556,456
1941	3,547,816	2,199,179	2,178,288	110,399,807	1,832,441,816	1,398,338	1,249,204	1,202,172	49,486,191	1,107,000,638	4,946,154	3,448,383	3,380,460	159,885,998	2,939,442,454
1942	3,487,944	2,688,723	2,615,048	193,783,707	2,026,225,523	1,360,757	1,247,512	1,206,651	78,264,809	1,185,265,447	4,848,701	3,936,235	3,821,699	272,048,516	3,211,490,970
1943	2,957,806	2,422,288	2,398,922	218,064,208	2,244,289,731	1,896,026	1,633,041	1,615,424	170,606,761	1,355,872,208	4,853,832	4,055,329	4,014,346	388,670,969	3,600,161,939
1944	2,970,714	2,468,842	2,475,280	224,683,280	2,468,973,011	1,969,281	1,694,861	1,664,069	186,543,084	1,542,415,292	4,939,995	4,163,703	4,139,349	411,226,364	4,011,388,303
1945	2,975,590	2,416,961	2,464,672	232,545,321	2,701,518,332	2,054,746	1,745,627	1,731,060	202,639,074	1,745,054,366	5,030,336	4,162,588	4,195,732	435,184,395	4,446,572,698
1946	3,079,761	2,513,687	2,567,050	279,711,300	2,981,229,632	2,071,070	1,808,282	1,829,531	250,912,645	1,995,967,011	5,150,831	4,321,969	4,396,581	530,623,945	4,977,196,643
1947	3,091,977	2,629,727	2,683,253	300,474,560	3,281,704,192	2,074,806	1,831,975	1,871,099	254,946,244	2,250,913,255	5,166,783	4,461,702	4,554,352	555,420,804	5,532,617,447
1948	3,221,464	2,664,619	2,760,493	277,160,874	3,558,865,066	2,158,551	1,894,136	1,939,241	257,462,667	2,508,375,922	5,380,015	4,558,755	4,699,734	534,623,541	6,067,240,988
1949	3,296,297	2,792,108	2,848,896	277,347,763	3,836,212,829	2,382,215	2,028,481	2,067,338	238,981,245	2,747,357,167	5,678,512	4,820,589	4,916,234	516,329,008	6,583,569,996

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[1] Revised.

The volume of crops produced amounted to 13,225,070 tons, practically the same as 1948, compared with a record volume of over 14.4 million tons in 1946. Vegetable, truck, hay and forage crops totaled 59 percent of the 1949 tonnage. Generally favorable yields were obtained by irrigation farmers and water supplies were generally adequate for full crop production. Average yields of grain and forage crops were maintained at the fairly high level of 1948. Yields of alfalfa seed, most vegetable crops, sugar beets, and most deciduous fruits were higher in 1949 than 1948, but lower for potatoes, prunes, and citrus fruits; citrus yields were reduced by freezing weather during the early months of the year.

The cultivated acreage from which crop production was calculated in 1949 was 4,916,234, an increase of 216,500 cropped acres over that reported for 1948. Throughout the West a general increase in acreage of hay and forage crops and some reduction in sugar beet acreage occurred. The difference between the 4,916,234 acres cropped on Reclamation project farms and the 4,820,589 acres irrigated by Reclamation was due to some relatively small areas in dry farming on irrigated farms.

Livestock and equipment on Reclamation farms November 1, 1949, were valued at $220,000,000, approximately the same as the November 1948 value. Livestock value was $89,000,000, 76 percent represented by cattle, 12 percent by sheep, 5 percent by poultry, 3 percent by hogs, another 3 percent by horses and mules, and 1 percent by miscellaneous livestock. Equipment was valued at $131,000,000, with tractors, trucks, and other motor vehicles accounting for two-thirds of the value. Marked increases in inventory values of machinery and equipment on Reclamation projects have occurred in recent years; in 1949 the increase was only 4 percent, indicating that project farmers may have largely replaced machinery worn out during war years.

Income Taxes From Reclamation Areas

Income tax revenues from Federal Reclamation areas represent a return to the Federal Treasury over and above the return of appropriate reimbursable construction costs by the irrigators, and from power revenues.

Estimates were prepared of income taxes paid from seven selected project areas, including businesses and residents of adjacent towns. These estimates indicate that from these seven areas almost $57,000,000 was paid in individual income taxes in 1949 and about $384,000,000 since the initiation of Federal income taxes. Federal construction net expenditures for these same projects through May 31, 1950, total approximately $163,000,000. Thus, Federal income tax revenues amounted to about two and one-third times the Federal expenditures for irrigation development.

A break-down of the seven project areas and estimated individual income taxes follows:

Project area	1949	Total
Salt River project area, Arizona	$24, 643, 000	$164, 229, 000
Yuma project area, Arizona-California	2, 500, 000	17, 242, 000
Boise project area, Idaho	9, 465, 000	56, 568, 000
Yakima project area, Washington	19, 257, 000	136, 480, 000
Shoshone project area, Wyoming	260, 000	2, 629, 000
Sun River project area, Montana	368, 000	2, 917, 000
Lower Yellowstone project area, Montana-North Dakota	433, 000	3, 887, 000
Total	56, 926, 000	383, 952, 000

Individual income taxes from these areas in 1949 amounted to about $52 per irrigated acre, and the estimated cumulative total averaged about $351 per acre. These tax revenues represent not only taxes paid by irrigation farmers but also the taxes paid by the individuals of the nearby towns and villages whose business or employment is directly or indirectly attributable to the Reclamation development.

In addition to the above tax revenues an appropriate share of corporation income taxes and other Federal taxes are either directly or indirectly attributable to business and industrial activity resulting from Reclamation developments. Rough estimates of these additional Federal taxes were made of Maricopa County, Ariz., which represents the Salt River project area. These additional Federal revenues plus the $24,643,000 of individual income taxes would raise the total Federal tax revenue from that area in 1949 to over $65,000,000. Inclusion of all Federal taxes in the estimate for the seven project areas would raise the figure to about $86,000,000 for 1949 and to more than $500,000,000 for the 1916–49 period.

It is roughly estimated that about 1.4 billion dollars of individual income taxes or more than 2.0 billion of all Federal taxes have been paid into the Treasury since 1916 from all Federal Reclamation areas. This compares with a Federal construction cost on these projects of about $500,000,000. These estimates do not include projects under construction such as Columbia Basin, Central Valley, Hungry Horse, and Missouri Basin, nor power developments at Hoover, Fort Peck, Parker, and Davis Dams. Including these major projects under construction, Federal construction costs totaled 1.8 billion dollars at the end of the fiscal year, an amount about equivalent to the estimated returns in Federal taxes from all Reclamation projects and the nearby communities.

PUBLIC LAND OPENINGS

During fiscal year 1950, the Bureau conducted four land openings involving a total of 12,830 acres of irrigable land, public and Government-acquired, comprising 128 farm units. These openings were as follows:

Project	Acreage	Units
Boise-Payette division, Idaho	4,489	50
Yakima-Roza division, Washington	723	11
Riverton, Wyo	6,940	54
Columbia Basin, Wash	678	13
Total	12,830	128

The units on Columbia Basin project were offered for outright purchase, as in the fiscal year 1949 opening, rather than for acquisition through homesteading. This latest opening marked the second such sale of lands served by irrigation facilities of Columbia Basin project.

Although the number of acres available for homesteading in fiscal year 1950 was less than half the number available in fiscal year 1949, there has been continued interest in the openings as evidenced by the large number of requests for applications. In the Boise project opening alone more than 12,000 requests for applications were received. Veterans from 41 States and far-off Arabia filed applications for farm units in the most recent of the land openings, on the Riverton project.

Up to the end of the fiscal year, the Bureau had conducted 21 postwar land openings with a total of 82,599 acres, including 878 farm units, opened either to homestead entry or, in the case of Columbia Basin project, to purchase. In all openings, veterans were given preference in the submission of applications, and their demands for public-land farm units has greatly exceeded the supply, averaging 29 applications for each available unit. Thus, unfortunately, for each veteran who succeeded in obtaining a farm unit, 28 were disappointed.

During fiscal year 1951 additional units on Riverton project, Wyoming, and Columbia Basin project, Washington, are expected to be opened for settlement, and a few additional units on one or more of the other Bureau projects may be available. It is planned to make available for sale during the first half of the fiscal year, 56 part-time farm units on Columbia Basin project. Considerable attention has been devoted during fiscal year 1950 to developing policies and procedures in connection with this first sale of part-time units on a Reclamation project.

Settler Assistance

Development farms.—Nine development farms have been established by the Bureau of Reclamation, as a phase of its settler assistance program, in cooperation with the several State agricultural colleges. The one most recently established is on Frenchman-Cambridge division of Missouri River Basin project in Nebraska, where a privately owned 95-acre unit was selected. Considerable research is being done on these farms for irrigation development, by the colleges, the Bureau of Plant Industry, Soils, and Agricultural Engineering, the Soil Conservation Service, and other agencies. Establishment of several additional development farms is anticipated within the next 2 years.

Inasmuch as several Bureau regions have been developing and operating development farms by substantially different means, the Chief of Land Development, Columbia Basin project, was directed to make a study of methods being used or contemplated on such farms in the various regions. Differences can be attributed largely to the ownership of the land on which the farms are located and to variance in local circumstances. Result of the study was made available early in 1950 in a factual report setting forth the purposes of development farms, nature of the work conducted, methods of establishment and operation, and cooperative relationships with State and Federal agencies in the program.

Credit for settlers.—Limited finance of settlers on projects of the Bureau of Reclamation has been a persistent problem. Despite this fact, the 104 settlers who obtained farm units on the Heart Mountain division of Shoshone project in the fall of 1949 had 60 percent of their acreage in crops by the spring of 1950. Under provisions of Public Law 361, Eighty-first Congress, it is now possible for the Farmers Home Administration, Department of Agriculture, to make loans to settlers on public land previous to the time the settler receives patent to the land.

A memorandum of understanding between the Departments of the Interior and Agriculture, outlining the general procedure to be followed by the Farmers Home Administration, the Bureau of Land Management, and the Bureau of Reclamation when the former agency extends financial assistance to settlers on public land, has been approved. This increase in credit availability has been of material assistance to the settlers in developing their farm units. But credit facilities to settlers are still not entirely adequate, as development of private lands for irrigation will create new problems of financial assistance.

Cooperation with other agencies.—It is the policy of the Bureau of Reclamation to continue obtaining technical information and assistance with the agricultural and economic phases of its program through cooperation with the State colleges of agriculture and agencies of the United States Department of Agriculture. In this connection the Bureau has in effect at the present time 35 memoranda of understanding with the State colleges and other agencies. During the fiscal year, memoranda of agreement were effected in connection with the following projects: Tucumcari, Missouri River Basin, Riverton, Columbia Basin, Shoshone, Kendrick, and Rio Grande.

Representatives of the Division of Land Economics and the Division of Farm Management and Costs, both of the Bureau of Agricultural Economics of the Department of Agriculture, have cooperated with the Bureau of Reclamation in securing more information as to the type and extent of land-use integration which has developed between existing irrigated areas and surrounding dry-land and range area and in developing a type of program which will intensify and expand the desirable types of land-use integration.

With respect to the agricultural economy, such integration may be separated readily into two types, i. e., within farms and between farms or between areas. In addition, the increased and more stabilized production resulting from irrigation generally results in building up the community or urban economy. Although considerable information is available bearing on these various types of integration, additional studies will be pursued to determine more precisely their nature and extent and the specific types which should be fostered.

Amendatory and New Repayment and Water Service Contracts

The full stride set in fiscal year 1949 in the Bureau's repayment program was maintained throughout fiscal year 1950. Significant progress was made toward disposing of the backlog of financial adjustment investigations on operating projects. Negotiations for new repayment and water-service contracts kept abreast of the accelerated construction program. The guiding principle for these negotiations remains the same: that repayment arrangements should be tailored to fit the payment capacity of the water users.

During fiscal year 1950, negotiations of amendatory repayment contracts for six projects were completed under provisions of section 7 of the Reclamation Project Act of 1939. Congressional approval was given to the results of these negotiations in Public Law 419, Eighty-first Congress, first session. Under authority of this law, the following amendatory repayment contracts were executed:

Oregon: Vale project, Vale irrigation district; Umatilla project, Stanfield irrigation district and Westland irrigation district.

South Dakota: Belle Fourche project, Belle Fourche irrigation district.
Washington: Yakima project, Prosser irrigation district.
Wyoming: Shoshone project, Deaver irrigation district.

The Bureau's rehabilitation and betterment program is based on Public Law 335, Eighty-first Congress, first session, which requires full reimbursement of funds expended. This program was placed in full operation during fiscal year 1950, thus requiring considerable additional repayment contract negotiation, some of which was on an emergency basis. This additional load was handled successfully and repayment arrangements were negotiated for 11 projects.

These negotiations were conducted under procedures prescribed by Public Law 335, and its amendment, Public Law 451, Eighty-first Congress, second session, which requires approval of repayment arrangements by the Senate Committee on Interior and Insular Affairs and the House Committee on Public Lands before expenditures can be made on rehabilitation and betterment work. These requirements were met for six projects through special provisions in amendatory repayment contracts negotiated under section 7 of the Reclamation Project Act as cited above. The remaining five cases involved only rehabilitation and betterment and received specific approval of the two congressional committees. The 11 projects involved, by States, are as follows:

Arizona: Salt River project.
California: Orland project.
Colorado: Grand Valley project.
Montana: Bitter Root project; Milk River project.
Nebraska-Wyoming: North Platte project.
Oregon: Vale project.
South Dakota: Belle Fourche project.
Washington: Yakima project, Prosser irrigation district.
Wyoming: Riverton project; Shoshone project.

Physical and economic analyses were completed and negotiations well advanced during the fiscal year in connection with financial adjustment investigations leading to amendatory repayment contracts on the following:

Idaho: Boise project, Black Canyon irrigation district; Owyhee project (eight districts).
Montana: Milk River project, Malta irrigation district and Glasgow irrigation district; Frenchtown project, Frenchtown irrigation district.
Oregon: Umatilla project, Hermiston irrigation district and West Extension irrigation district; Deschutes project, North Unit irrigation district.
Utah: Ogden River project, Ogden River Water Users' Association; Hyrum project, South Cache Water Users' Association.
Washington: Yakima project, Roza irrigation district.

Financial adjustment investigations were in various stages of completion on 19 additional projects.

In connection with the rehabilitation and betterment program, negotiations were under way at the end of fiscal year 1950 for repayment contracts for the following:

Montana: Sun River project.
New Mexico-Texas: Rio Grande project.
Washington: Okanogan project; Yakima project, Storage division.

In connection with construction of new projects or units of projects, the repayment contract program involved negotiation of one water-service contract under the provisions of section 9 (e) of the Reclamation Project Act of 1939, two repayment contracts under section 9 (d) of the same act or other comparable legal provisions, and/or three combination water-service and repayment contracts. Under the combination plan, the cost of the distribution system is contracted for repayment under section 9 (d) and water service is provided under section 9 (e), both in the same contract.

During fiscal year 1950, 13 new repayment contracts were executed with the following water users' organizations:

Arizona: Yuma project, Arizona Edison Co. (municipal water), and sale of waste and drainage water to Mexico.
California: Central Valley project, Contra Costa County water district (interim) and Ivanhoe irrigation district; Cachuma project, Santa Barbara County water agency.
Montana: Milk River project, city of Havre.
New Mexico: Fort Sumner project, Fort Sumner irrigation district; Tucumcari project, city of Tucumcari.
North Dakota: Missouri River Basin project, city of Dickinson.
Oregon: Deschutes project, Grants Pass irrigation district and Ochoco irrigation district.
Texas: Rio Grande project, city of El Paso and Hudspeth County conservation and reclamation district No. 1.

At the close of the fiscal year, negotiations had been completed on 12 additional contracts which were pending formal execution by either the water users or the Government. These involve the following water users' organizations:

Arizona: Gila project, North Gila Valley irrigation district.
California: Central Valley project, Chowchilla water district, Exeter irrigation district, Lindsay-Strathmore irrigation district, Madera irrigation district, Saucelito irrigation district, Stone Corral irrigation district, Terra Bella irrigation district, and Tulare irrigation district.
North Dakota: Missouri River Basin project, Heart River irrigation district.
Wyoming: Eden project, Eden Valley irrigation and drainage district; Missouri River Basin project, Owl Creek irrigation district.

In addition, detailed physical and economic investigations were completed and negotiations were advanced on 20 water service and/or repayment contracts involving new projects or new project units.

Urban population growth through out the West is increasing the need for development of supplemental municipal water supplies. During the past year, seven contracts were negotiated to provide additional municipal supplies from Reclamation projects. It is anticipated that the growing competition for limited water resources will require increasing attention to municipal and industrial water requirements, both from existing Reclamation projects and in the authorization of future projects. Full water resource development in connection with multiple-purpose basin developments will necessarily entail proper integration and recognition of municipal water requirements.

Cooperation With Design and Construction

The Branches of Design and Construction and Operation and Maintenance have taken positive steps during the past year to assure that the members of both branches cooperate to the fullest extent in ironing out possible future problems which may be taken care of in the design stage of any new project or individual structure. The Chief Engineer has appointed an engineer with years of experience in both design and project operation and maintenance to spearhead this task.

Rehabilitation and Betterment

At the close of the fiscal year, much badly needed rehabilitation and betterment work on the physical plants of older irrigation projects had been completed and the volume of work in progress was increasing steadily. The $2,500,000 appropriated by the Congress for this work during the year was allotted as follows:

Project:	*Allotment*
Salt River, Ariz	$790,000
Orland, Calif	114,250
Grand Valley, Colo	730,000
Bitter Root, Mont	15,000
Milk River, Mont	23,250
Sun River, Mont	2,000
North Platte, Wyo.-Nebr	80,000
Vale, Oreg	50,000
Belle Fourche, S. Dak	100,000
Okanogan, Wash	5,500
Riverton, Wyo	379,000
Shoshone, Wyo	211,000
Total	2,500,000

Following the depression years prior to World War II and the restrictions on manpower, equipment, and materials during the war, deferment in maintenance of the physical plant of many of the older irrigation projects approached a critical stage. A survey of then existing conditions, authorized and executed during 1946 and 1947 on 51 projects or divisions of projects, revealed that thousands of wood structures constructed from 20 to 30 years ago were in need of replacement; many concrete and steel structures were badly in need of repair or replacement; canals, laterals, wasteways, and drains badly needed cleaning to restore them to their original capacities; additional canal lining to prevent excessive loss of water was needed; additional drain ditches were required to prevent further waterlogging of lands; and additional roads and cattle guards and many other items were mandatory to restore the projects to their original operating condition.

This program was initiated in fiscal year 1949 by an appropriation of $1,500,000 and the funds were allotted to nine projects showing the greatest need for immediate aid.

It was intended from the inception of the program that the costs would be repaid by the water users in installments over a sufficient number of years. In order to clear up misunderstandings that had arisen and caused some delays in the program, Public Law No. 335 was enacted in the first session of the Eighty-first Congress, and an amendment thereto, Public Law No. 451, enacted in the second session, prescribes procedures for negotiation and approval of repayment contracts in connection with expenditures of rehabilitation and betterment funds.

SPRINKLER IRRIGATION

Investigation of the possibilities of sprinkler irrigation has been intensified during the past year through operation and observation of the sprinkler systems installed by the Bureau on Columbia Basin project in Washington, Missouri Basin project in both North and South Dakota, and on Gila project in Arizona.

Many types of systems being used on a large variety of crops and under a wide range of conditions continue to indicate that sprinkler irrigation is well established as a successful practice with most crops and on most arable lands. It does not appear to be as economical or otherwise superior to surface methods on lands well adapted to the latter.

A preliminary report on these investigations, prepared during fiscal year 1949, proved so popular that the original supply was soon exhausted. In December 1949 the report was fully revised to reflect all new developments, and is now available to the public. Sprinkler irrigation may be purchased from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., price 20 cents.

Lower Cost Canal-Lining Program

A growing concern about the loss of water from irrigation canals and laterals and the excessive cost of making canals and laterals reasonably watertight prompted the Bureau to initiate a lower-cost canal-lining program in 1946, aimed at the development of more economical methods of seepage control. The program has progressed through laboratory tests and experimental field installations of various types of materials and construction methods.

Certain phases of the work have been performed by the State colleges and universities with the assistance of the Soil Conservation Service in making cooperative studies. Progress during the first 2 years was covered in a general information report entitled "Lower Cost Canal Linings," dated June 1948. Subsequently, a number of special reports on equipment development, trial installations, cooperative tests, and condition surveys have been issued.

The most outstanding accomplishments to date are development of placing methods and equipment; relaxing of specification restrictions of line and grade, and finish of concrete and mortar; elimination of reinforcing steel when not required for safety; development of buried asphalt membrane lining, covered with a protective blanket of earth or gravel; and greater utilization of thick compacted earth linings of selected earth.

Findings and developments in this program have been utilized in design and construction of new projects and in rehabilitation and betterment of older, existing projects. Worth-while savings are being realized.

Soil- and Moisture-Conservation Operations

The soil- and moisture-conservation program of the Bureau is a minor item in comparison with the total over-all Reclamation program, but it is particularly important in connection with the prevention of siltation of reservoirs and the protection of water-distribution systems above Reclamation projects.

Within the limit of the funds made available to the Bureau for these purposes, control of accelerated erosion on public lands under its jurisdiction and protection of the watersheds above Reclamation projects are being accomplished. This is being done both through individual effort of the Bureau and through effective cooperation with all other interested agencies in each of the areas concerned, particularly with the Bureau of Land Management, the Bureau of Indian

Affairs, the Forest Service, the Soil Conservation Service, and various soil-conservation districts.

The prevention of water losses, including correction of wasteful practices in the distribution and use of water on irrigation projects, is gaining recognition as equal in importance to the prevention of soil erosion. This activity is receiving increasing consideration in our current work and in planning for future operations under the soil- and moisture-conservation program.

Weed Control

Greater emphasis has been placed during the fiscal year on the Bureau's weed-control program, and effective results are evident in most regions. The control of new willow growths has become a simple operation with newly developed Bureau techniques, and the control of waterweeds in many instances has been reduced to a routine operation with aromatic solvents. New chemicals, equipment, and methods are beginning to show large savings, not only in labor and chemical costs, but also in irrigation water.

Recommendations for the use of aromatic solvents in the control of waterweeds in irrigation channels have been revised, and more than double the amount of the chemical formulation applied in 1949 will be used in 1950. The formulation developed through the Bureau of Reclamation's cooperative research program with the Bureau of Plant Industry has been more effective this year due to better emulsifying agents, tested and approved by the Chief Engineer's office.

Several of the regions have made special investigations of the salt cedar control problem, including a determination of water losses caused by the plants, methods of control, and other factors. This program has been coordinated with other agencies interested in the effect of the plants on land use, flood control, and water conservation, and much progress made through meetings with inter-agency and intra-agency committees that have been recently established.

Official status has been given to the Department of the Interior Weed Control Committee, which has as its principal function the exchange of weed-control information among the Department of the Interior agencies having weed problems on lands under their jurisdiction.

A revision has been made in the Bureau's weed manual, Control of Weeds on Irrigation Systems, and the revised publication has been made available for general distribution.

Bureau personnel are engaged in the preparation of a motion picture entitled "Weed Control on Irrigation Systems," which will demonstrate the most effective methods of controlling weeds on Bureau rights-of-way and other lands under Bureau jurisdiction. Prints of the film are expected to be available early in 1951. It is believed that the new methods developed through cooperative research with the Department of Agriculture can best be shown to irrigation districts through visual methods.

Payments to School Districts

On August 1, 1949, the Secretary of the Interior delegated authority to the Commissioner of Reclamation, by order No. 2529, for furnishing assistance under the provisions of the act of June 29, 1948 (43 U. S. C. A., sec. 385a), and legislation supplementary thereto, to local school districts on which an undue burden is cast by reason of the construction activities of the Bureau.

The Commissioner's order No. 1, dated December 20, 1949, redelegated to regional directors authority for furnishing assistance at a rate not exceeding the average per pupil cost of the State in States in which school funds are equalized, and at a rate not exceeding the average per pupil cost of the school district in States in which school funds are not equalized.

Amendment No. 1 to order No. 2529 delegated to the Commissioner, without authority of redelegation, authority for giving additional assistance to local school districts in cases where extraordinary circumstances or conditions indicate that in fairness and equity a rate above that provided in the original order should be paid.

During the year cooperative agreements covering school assistance were negotiated with the following: Trenton, Nebraska, school district (Trenton Dam); Indianola, Nebraska, school district No. 2 (Frenchman-Cambridge unit); rural school district No. 9, Crook County, Wyo. (Keyhole Dam); York consolidated school district, Lewis and Clark County, Mont. (Canyon Ferry Dam)—all in the Missouri River Basin project; School district No. 18 (Platoro Dam), San Luis Valley project, Colorado; Grand Coulee school district No. 55, and Quincy school district No. 144, Grant County, both in the Columbia Basin project, Washington. Negotiations were under way at the close of the fiscal year for rendering assistance to other eligible school districts.

Recreational Use of Reservoirs

Construction of dams and reservoirs for irrigation and power development provides incidental but very definite benefits to the public through the creation of exceptional recreational opportunities.

At the larger reservoirs, such as Lake Mead, on the Colorado River between Arizona and Nevada; Franklin D. Roosevelt Lake, on the Columbia River in Washington; and Millerton Lake, on the San Joaquin River in California, the administration of recreational facilities is handled for the Bureau by the National Park Service. At certain other reservoirs located within National Forest boundaries, recreational facilities are administered by the United States Forest Service.

As a prerequisite to achievement of a program for optimum recreational use of all existing Reclamation reservoirs, as well as for those under construction or still under investigation, legislation is required to provide for the expenditure of nonreimbursable funds for development and administration of these recreational resources.

POWER UTILIZATION

A new record of achievement in hydroelectric power capacity and production on multipurpose Federal Reclamation projects was accomplished during fiscal year 1950.

By year's end, the total installed capacity was 3,168,400 kilowatts, highest in Bureau of Reclamation history. Sales of electric energy during the year totaled approximately 19,790,000,000 kilowatt-hours, which brought in revenue about $33,200,000. Additional capacity to be added in fiscal year 1951 will approximate 663,000 kilowatts.

Although previous records of capacity and generation are surpassed with the installation of each additional unit of Reclamation projects, demands for electric power still remain unsatisfied. Applications for power continue to mount and contracts for energy sales are being processed in great numbers to provide for the utilization of power to be generated from plants now under construction.

Expansion of rural electrification is a major factor contributing to the increasing power requirements in many areas, particularly in Missouri River Basin States. Shortages of power of particular note have occurred in North and South Dakota.

To alleviate the critical situation, the Bureau has been authorized by the Congress to advance the construction of portions of its ultimate power system. These portions will be utilized to serve cooperative loads from available sources and from proposed Rural Electrification Administration generation plants until such time as the ultimate system is required to market Federal power.

Advancing construction of transmission lines and substations even a few years means the difference between keeping these cooperatives alive or letting them remain dormant until added capacity is available. This cooperative arrangement demonstrates clearly what can be accomplished by coordinated development of the Federal program.

Wheeling arrangements, whereby Reclamation power is transmitted over the lines of private utilities, constitute another significant factor in the utilization of Federal electric output to a maximum of capacity. Such arrangements have been consummated with a number of private utilities and are under active negotiation with other utilities operating in Reclamation areas. Through these, existing utility capacity is utilized to the maximum extent possible for serving areas at an earlier date or at a more economical cost to the Reclamation project.

In many instances it has been possible by wheeling and interchange arrangements to provide power to preference customers, especially Rural Electrification Administration cooperatives, well in advance of the time when additional service can be made available to them by construction of added capacity and necessary transmission systems. These arrangements also permit delivery of power to areas remote from Federal power plants and beyond the present economical transmission distance but which can be served by maximum utilization of existing facilities, by displacement.

Irrigation pumping continues to impose greater demands upon the Reclamation power systems. It has been proven that tapping underground sources of water to permit irrigation of additional areas has been a boon to agricultural development, but electric power is necessary for the pumping.

The Bureau is continuing to plan development of a program to increase the power available consistent with full development and utilization of western water resources.

Present Installed Capacity

The installed nameplate capacity of 3,168,400 kilowatts in the 19 power plants in operation by the Bureau of Reclamation at the end of fiscal year 1950, showed an increase of 411,000 kilowatts capacity over the 1949 fiscal year. The increase resulted from the addition of 3 generating units of 108,000 kilowatts each at Grand Coulee power plant on Columbia River Basin project in Washington, 3 units of 25,000 capacity each at Keswick power plant on Central Valley project in California, and the first of 3 units of 12,000 capacity each at Kortes power plant on Missouri River Basin project in Wyoming. Power plants operated by other agencies, principally water users' organizations, on Reclamation projects totaled 16 of which 9 with a total installed capacity of 30,967 kilowatts were installed by the Bureau of Reclamation, and 7 with a total installed capacity of 62,900 kilowatts by others.

Dedications of Shasta and Grand Coulee Dams were the most significant events concerning hydroelectric power development during the fiscal year. Shasta's dedication marked completion of the installations at Shasta and Keswick power plants. At the time of Grand Coulee dedication, the total number of main generating units at its power plant had been brought to 13, making it the largest power plant in the world with a present installed capacity of 1,424,000.

Additional Capacity Under Construction

Under construction by the Bureau during the year were 10 new power plants, which will have an ultimate capacity of 892,100 kilowatts. A contract was awarded for a turbine and generator for 1 additional 50,000-kilowatt unit at Hoover power plant on the Boulder Canyon project, while fabrication was continued on 2 units of 82,500 kilowatts each for which contracts were awarded in fiscal year 1949.

Completion of Keswick power plant on Central Valley project, with an installed capacity of 75,000 kilowatts in three generating units, brings the total installed capacity on the project to 454,000 kilowatts, including both Shasta and Keswick plants. The first unit in Kortes power plant on Missouri River Basin project was placed in operation this year. Construction is continuing on the remaining 2 units in Kortes power plant for completion during the early part of fiscal year 1951, to bring the total capacity in the plant to 36,000 kilowatts.

Marys Lake power plant of 8,100-kilowatts capacity and Estes power plant of 45,000-kilowatts capacity, now under construction on Colorado-Big Thompson project in Colorado, are scheduled for initial seasonal operation during the summer of 1950. These will bring into operation the initial phase of the eastern slope power development of this project. Work is progressing on approximately 100,000 kilowatts of additional capacity to develop the power drop between Estes power plant and Foothills storage system of the project, scheduled for initial operation in fiscal year 1953.

On Missouri River Basin project, work is progressing on Boysen Dam and power plant in Big Horn Basin in Wyoming. The power plant of 15,000-kilowatt capacity is scheduled for operation in fiscal year 1952. Davis Dam and power plant, located on the Colorado River downstream from Hoover Dam, is scheduled for operation in the spring and early summer of 1951 with an installed capacity of 225,000 kilowatts. The power plant at Anderson Ranch Dam in Idaho will have an initial installed capacity of 27,000 kilowatts and is scheduled to be placed in operation in the fall of 1950.

Hungry Horse Dam and a power plant of 285,000 kilowatts, now under construction on the South Fork at Flathead River in Montana, is scheduled for initial operation in October 1952, with the second unit in operation by December of that year. The remaining two units are scheduled for operation in August and November of 1953. Canyon Ferry power plant in Montana, now under construction, will begin initial operation in November 1953.

The Bureau of Reclamation is responsible for marketing power generated at dams constructed by the Department of the Army's Corps of Engineers in Missouri River Basin, and therefore has an interest in their construction progress since power requirements of the basin areas indicate the immediate need for additional generating capacity. The Engineers Corps is progressing on the installation of a third unit on Fort Peck project in Montana with a 35,000-kilowatt capacity, scheduled to be in operation in 1952. They have Garrison Dam in North Dakota and Fort Randall Dam in South Dakota under active construction. Although power requirements of both these areas indicate immediate need for additional generating capacity, the initial operating schedule for Garrison is tentatively 240,000 kilowatts capacity in fiscal years 1955 and 1956, and for Fort Randall, 160,000 kilowatts in fiscal years 1954 and 1955. Actual progress which can be accomplished is contingent upon appropriations to meet these schedules.

The status of hydroelectric power plants on Reclamation projects, in operation, under construction, or authorized is shown in table 9.

TRANSMISSION LINES

At the close of fiscal year 1950, the Bureau had about 4,400 miles of high-voltage transmission lines in operation. Principal lines placed in operation during the year were as follows:

Project	Voltage	Completed	Length
	Kilovolts		*Miles*
Yakima: Pumping plant supply line	34.5	May 1950	62.0
Central Valley:			
Gas Point Rd. to Pacific Gas & Electric Co. substation	230	November 1949	7.4
Shasta power plant to Gas Point Rd	230	November 1949	22.0
Keswick Junction to Keswick power plant	230	November 1949	2.0
Davis: Coolidge to electric district No. 5	115	May 1950	31.0
Missouri River Basin:			
Miles City to Glendive	115	August 1949	78.0
Fort Peck to Williston-Garrison	115	November 1949	309.0
Kendrick: Seminoe to Casper	115	October 1949	63.0
Missouri River Basin:			
Gering to Alliance	115	August 1949	47.0
Cheyenne to Pine Bluff	115	August 1949	37.0
Sterling to Sidney	115	January 1950	39.0
Colorado-Big Thompson:			
Wiggins to Hoyt	115	December 1949	15.0
Flatiron to Greeley	115	February 1950	28.0
Brush to Yuma	69	February 1950	77.0
Yuma to Wray	69	June 1950	
Pole Hill to Flatiron	115	June 1950	5.0
Total			822.4

Construction was continuing on more than 2,000 miles of high-voltage lines at the end of the fiscal year. These lines will be placed in operation during fiscal year 1951 or in subsequent fiscal years.

ELECTRIC-ENERGY SALES

Sales of electric energy and power revenues by the Bureau of Reclamation reached an all-time high during the fiscal year. The total,

TABLE 9.—*Hydroelectric plants on Reclamation projects, operating, under construction,* [illegible]

CONSTRUCTED AND OPERATED BY BUREAU OF RECLAMATION

State	Project	Name of plant	Year of initial operation	Existing nameplate capacity	Ultimate nameplate capacity	Number of existing generators and capacities	Ultimate number of generators and capacities
				Kilowatts	*Kilowatts*	*Kilowatts*	*Kilowatts*
Arizona-Nevada	Boulder Canyon	Hoover [1]	1936	1,034,800	1,332,300	12-82,500; 1-40,000; 2-2,400	15-82,500; 1-40,000; 1-50,000; 2-2,400.
Arizona-California	Parker	Parker	1942	120,000	120,000	4-30,000	4-30,000.
California	Central Valley	Shasta	1944	379,000	379,000	5-75,000; 2-2,000.	5-75,000; 2-2,000.
Do	do	Keswick	1950	75,000	75,000	3-25,000	3-25,000.
Do	Yuma	Siphon Drop	1926	1,600	1,600	2-800	2-800.
Colorado	Colorado-Big Thompson	Green Mountain	1943	21,600	21,600	2-10,800	2-10,800.
Idaho	Boise	Boise Diversion	1912	1,500	1,500	3-500	3-500.
Do	do	Black Canyon	1925	8,000	8,000	2-4,000	2-4,000.
Do	Minidoka	Minidoka	1909	13,400	13,400	1-5,000; 1-2,400; 5-1,200	1-5,000; 1-2,400; 5-1,200.
Wyoming	North Platte	Guernsey	1927	4,800	4,800	2-2,400	2-2,400.
Do	do	Lingle	1919	1,400	1,400	2-400; 2-300	2-400; 2-300.
New Mexico	Rio Grande	Elephant Butte	1940	24,300	24,300	3-8,100	3-8,100.
Washington	Columbia	Grand Coulee [2] [3]	1941	1,424,000	1,974,000	13-108,000; [3] 2-10,000	18-108,000 [3]; 3-10,000.
Do	Yakima	Prosser [12]	1932	[12] 2,400	[12] 2,400	1-2,400	1-2,400.
Wyoming	Kendrick	Semino	1939	32,400	32,400	3-10,800	3-10,800.
Do	Missouri Basin	Kortes	1950	12,000	36,000	1-12,000	3-12,000.
Do	Riverton	Pilot Butte	1925	1,600	1,600	2-800	2-800.
Do	Shoshone	Heart Mountain	1948	5,000	5,000	1-5,000	1-5,000.
Do	do	Shoshone	1922	5,600	5,600	1-4,000; 2-800	1-4,000; 2-800.
Subtotal				3,168,400	4,037,500		

CONSTRUCTED BY BUREAU OF RECLAMATION; OPERATED BY OTHERS

State	Project	Name of plant	Year of initial operation	Existing nameplate capacity	Ultimate nameplate capacity	Number of existing generators and capacities	Ultimate number of generators and capacities
Arizona	Salt River	Roosevelt	1909	15,400	15,400	5-1,080; 1-4,000; 1-6,000	5-1,080; 1-4,000; 1-6,000.
Do	do	Arizona Falls [4]	1913	850	850	2-425	2-425.
Do	do	Cross Cut [4]	1914	5,100	5,100	1-3,000; 3-700	1-3,000; 3-700.
Do	do	S. Consolidated [4]	1912	1,600	1,600	2-800	2-800.
Colorado	Grand Valley	Grand Valley (Palisades)	1932	3,000	3,000	2-1,500	2-1,500.
Nevada	Newlands	Lahontan	1911	1,780	1,920	1-500; 2-640	3-640.
Oregon	Deschutes	Cove [5]	1946	1,500	1,500	1-1,500	1-1,500.
Utah	Strawberry Valley	Spanish Fork [6]	1908	1,550	1,550	2-450; 1-250; 1-400	2-450; 1-250; 1-400.
Washington	Yakima	Rocky Ford	1916	187	187	1-187	1-187.
Subtotal				30,967	31,107		

See footnotes at end of table.

TABLE 9.—*Hydroelectric plants on Reclamation projects, operating, under construction, or authorized as of June 30, 1950*—Continued

State	Project	Name of plaut	Year of initial operation	Existing nameplate capacity	Ultimate nameplate capacity	Number of existing generators and capacities	Ultimate number of generators and capacities
CONSTRUCTED AND OPERATED BY WATER USERS ORGANIZATIONS							
				Kilowatts	*Kilowatts*	*Kilowatts*	*Kilowatts*
Arizona	Salt River	Chandler [9]	1919	600	600	1-600	1-600.
Do	do	Horse Mesa [9]	1927	30,000	30,000	3-10,000	3-10,000.
Do	do	Mormon Flat [7]	1926	7,000	7,000	1-7,000	1-7,000.
Do	do	Stewart Mtn. [7]	1930	10,400	10,400	1-10,400	1-10,400.
California	All-American	Drop No. 3 [8]	1941	4,800	9,600	1-4,800	2-4,800.
Do	do	Drop No. 4 [8]	1941	9,600	19,200	1—9,600	2-9,600.
Oregon	Klamath	"C" Canal Drop [9]	1938	500	500	1-500	1-500.
Subtotal				62,900	77,300		
CONSTRUCTED AND OPERATED BY CORPS OF ENGINEERS, DEPARTMENT OF THE ARMY; POWER MARKETED BY BUREAU OF RECLAMATION							
Montana	Fort Peck	Fort Peck	1943	50,000	105,000	1-35,000; 1-15,000	3-35,000.
Subtotal				50,000	105,000		
UNDER CONSTRUCTION BY BUREAU OF RECLAMATION							
Arizona-Nevada	Davis	Davis	1951	0	225,000	0	5-45,000.
Colorado	Colorado-Big Thompson	Estes	1950	0	45,000	0	3-15,000.
Do	do	Marys Lake	1950	0	8,100	0	1-8,100.
Idaho	Boise	Anderson Ranch	[10] 1950	0	[11] 40,500	0	3-13,500.
Do	Palisades	Palisades	1956	0	112,500	0	5-22,500.
Montana	Missouri Basin	Canyon Ferry	1953	0	50,000	0	3-16,667.
Do	Hungry Horse	Hungry Horse	1952	0	285,000	0	4-71,250.
Wyoming	Missouri Basin	Boysen	1952	0	15,000	0	2-7,500.
Subtotal				0	781,100		
UNDER CONSTRUCTION BY CORPS OF ENGINEERS, DEPARTMENT OF THE ARMY; POWER TO BE MARKETED BY BUREAU OF RECLAMATION							
North Dakota	Missouri Basin	Garrison	1955	0	400,000	0	5-80,000.
South Dakota	do	Ft. Randall	1954	0	320,000	0	8-40,000.
Subtotal				0	720,000		

AUTHORIZED TO BE CONSTRUCTED BY

California	Central Valley	Folsom and Folsom Afterbay	1954	0	160,000	0	3-40,000; 2-20,000.
Do	do	Nimbus	1953	0	5,000	0	1-5,000.
Colorado	Colorado-Big Thompson	Polehill	1953	0	32,800	0	2-16,400.
Do	do	Flatiron	1953	0	63,000	0	2-31,500.
Do	do	Big Thompson		0	6,700	0	1-6,700.
Montana	Missouri Basin	Angostura	1951	0	1,200	0	1-1,200.
Do	do	Lower Marias (Kenil)		0	1,600	0	2-800.
Do	do	Lyon	1959	0	24,000	0	3-8,000.
Do	do	Mission		0	50,000	0	3-16,667.
Do	do	Portage	1958	0	20,000	0	2-10,000.
Do	do	Yellowtail	1956	0	200,000	0	4-50,000.
Nebraska	do	Harlan		0	1,200	0	1-1,200.
North Dakota	do	Crosby	1957	0	48,000	0	6-8,000.
Do	do	Des Lacs	1957	0	60,000	0	6-10,000.
South Dakota	do	Miller Drop	1960	0	180,000	0	4-45,000.
Washington	Yakima-Roza Division	Roza	1953	0	10,000	0	2-5,000.
Do	Yakima-Kennewick Division.	Chandler	1953	0	12,000	0	2-6,000.
Wyoming	Missouri Basin	Bald Ridge	1959	0	30,000	0	3-10,000.
Do	do	Hunter Mountain	1960	0	12,000	0	2-6,000.
Do	do	Sunlight	1956	0	20,000	0	2-10,000.
Do	do	Thief Creek	1956	0	60,000	0	3-20,000.
Do	do	Tongue River		0	25,000	0	2-12,500.
Subtotal				0	1,022,500		

AUTHORIZED TO BE CONSTRUCTED BY CORPS OF ENGINEERS, DEPARTMENT OF THE ARMY; POWER TO BE MARKETED BY BUREAU OF RECLAMATION

South Dakota	Missouri Basin	Big Bend	1960	0	120,000	0	6-20,000.
Do	do	Gavins Point	1955	0	100,000	0	3-33,333.
Do	do	Oahe	1960	0	425,000	0	5-85,000.
Subtotal				0	645,000		
Total				3,312,267	7,419,507		

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[1] Power plant units operated by power allottees under agency contract.
[2] Power marketed by Bonneville Power Administration.
[3] Main Units with a nameplate rating at 108,000 kilowatts have continuous operating capacity of 120,000 kilowatts.
[4] Power plant constructed by Bureau of Reclamation with Salt River Valley Water Users' Association funds.
[5] Unit No. 3 installed in Pacific Power & Light Co.'s plant.
[6] Three plants: (a) Spanish Fork (upper); (b) Spanish Fork (lower); (c) Payson.
[7] Constructed and operated by Salt River Valley Water Users' Association.
[8] Constructed and operated by Imperial irrigation district.
[9] Constructed and operated by Enterprise irrigation district.
[10] First 2 units completed.
[11] 27,000 kilowatts authorized.
[12] Prosser will be removed when Chandler is built.

not including transactions between Bureau projects, approximated 19.79 billion kilowatt-hours in sales, and approximately 33.2 million dollars in revenues.

The Bureau marketed the output from the 19 power plants it operated and, under the provisions of the Fort Peck Project Act of 1938, from the Fort Peck power plant, operated by the Corps of Engineers.

The 1950 fiscal year sales and revenues compare to a total of approximately 18.32 billion kilowatt-hours sold during fiscal year 1949, and approximately 32.23 million dollars in revenues that year.

This increase in sales and revenues resulted from the continuing heavy demands for electric power, and integration of the Bureau's hydroelectric systems with other existing systems to obtain maximum power production from the water resources. A summary of power sales and revenues by projects is shown in table 10.

TABLE 10.—*Bureau of Reclamation power systems, power sales, and revenues by projects, fiscal year ending June 30, 1950*[1]

Project	Sales of electric energy	Revenues from sales of electric energy	Project	Sales of electric energy	Revenues from sales of electric energy
Region 1:	*Kilowatt-hours*		Region 6:	*Kilowatt-hours*	
Boise	39, 662, 240	$44, 814	Fort Peck	321, 952, 242	$991, 960
Columbia Basin	10,505,939,200	7, 443, 866	Riverton	32, 018, 806	196, 305
Minidoka	106, 260, 079	425, 156	Shoshone	56, 661, 399	336, 541
Yakima	23, 425, 046	60, 647	Region 7:		
Region 2: Central Valley	1, 529, 140, 444	9, 340, 727	North Platte	42, 466, 406	453, 975
Region 3:			Kendrick	132, 586, 923	777, 137
Boulder Canyon	5, 978, 672, 884	9, 375, 417			
Parker	801, 299, 081	2, 443, 750	Colorado-Big Thompson	126, 786, 499	881, 395
Yuma	9, 591, 857	36, 756			
Region 5: Rio Grande	83, 240, 543	402, 892	Total	19,789,703,649	33, 211, 338

[1] Does not include energy sales and revenues in transactions between Bureau projects.

POWER CONTRACTS

Electric power was delivered by the Bureau to numerous major and minor users of power during the fiscal year. Major deliveries were made to 26 municipalities, 7 State government agencies, 65 rural electric cooperatives, 4 Federal agencies, 41 public authorities, 27 commercial and industrial users, and 34 privately owned utilities. A summary by classification of customers for the 12 months ending June 30, 1950, is contained in table 11.

During the year, 84 contracts for delivery of power were executed. These include 2 contracts with irrigation districts, 4 with other Federal bureaus and agencies, 1 with public-power districts, 4 with State authorities, 15 with private utilities, 45 with rural electric cooperatives, 8 with municipalities, and 5 with other customers. A number of these contracts were renewals of expiring contracts or revisions resulting from changed conditions.

TABLE 11.—*Summary by classification of customers for 12 months ending June 30, 1950* [1]

	Number of customers	Sales of electric energy	Revenues from sales of electric energy
		Kilowatt-hours	
Privately owned utilities	34	4, 642, 908, 691	$15, 989, 939
Municipal utilities	26	3, 267, 200, 519	5, 292, 647
State government utilities	7	595, 634, 309	1, 592, 577
Cooperative utilities (Rural Electrification Administration projects)	65	136, 169, 449	925, 130
Other Federal utilities	4	10, 504, 740, 225	7, 519, 093
Residential and domestic	535	4, 777, 450	31, 924
Rural (other than Rural Electrification Administration projects)	8	105, 570	978
Commercial and industrial	27	64, 179, 539	401, 513
Public authorities	41	468, 825, 664	1, 233, 218
Interdepartmental	33	105, 157, 746	224, 276
Other sales	1	4, 487	43
Total all customers	781	19, 789, 703, 649	33, 211, 338

[1] Does not include energy sales and revenues in transactions between Bureau projects.

The contract between the Bureau and Montana-Dakota Utilities Co. was supplemented during the year to provide for service by the Bureau to additional preference customers. The wheeling arrangement now in effect between Montana-Dakota Utilities Co. and the Bureau has been instrumental in providing electric service to cooperatives not directly connected to Bureau transmission facilities. A wheeling contract with Otter Tail Power Co. has been executed to provide a similar service to preference customers in the section of Missouri River Basin project served by the company. Similar wheeling arrangements are now in process with other utilities in Missouri River Basin area.

At the beginning of fiscal year 1951, the Bureau had 242 contracts for delivery of power under negotiation. These include 7 with irrigation districts, 2 with public-power districts, 9 with Federal agencies and bureaus, 4 with State authorities, 27 with private utilities, 112 with REA cooperatives, 72 with municipalities, and 9 with other customers. A number of these are for the renewal of existing contracts or for revision to reflect changed conditions. A large number of contracts under negotiation are for future power deliveries at such time as additional generating capacity now under construction is placed in operation.

GENERAL INVESTIGATIONS

General investigations is that phase of Bureau of Reclamation activity concerned with resource investigations and developments of project plans. Its interest begins at the time the potential project is first considered for development and extends through project construction, development, and operation. The success of Reclamation projects is dependent not only upon sound planning but also effectuation of the plans and efficient operation of the project.

COMPREHENSIVE RIVER-BASIN SURVEYS

Planning and survey work for western resource development through Bureau of Reclamation projects on a comprehensive river-basin basis went forward during the fiscal year with certain significant accomplishments achieved.

A Report on Comprehensive Plan of Development of the Water and Related Resources of the Columbia River Basin, including recommended projects and a recommended basin-account plan, was submitted to the Congress and printed as House Document 473, Eighty-first Congress, second session.

The Bureau's report emanated from coordinated plans prepared late in fiscal year 1949 by both the Bureau and the Corps of Engineers for the comprehensive development of Columbia River Basin. It recommended that the initial units of the plan be authorized for construction and that the basin financial pooling plan be established. Projects recommended for construction by the Bureau included the following:

Project:	*State*
Bitterroot Valley	Montana
Cambridge Bench	Idaho
Canby	Oregon
Council	Idaho
Crooked River	Oregon
Hells Canyon	Idaho-Oregon
Mann Creek	Idaho
Missoula Valley, North Side unit	Montana
Columbia Basin modification of Grand Coulee Dam for flood control	Washington
Mountain Home	Idaho
The Dalles, West unit	Oregon
Upper Star Valley	Wyoming
Vale, Bully Creek extension	Oregon

One of the most important features of the Bureau's Columbia Basin report, the basin financial pooling plan, known as the "basin account," has two primary objectives, namely, to provide a basis for the establishment of power rates on a uniform basis or region-wide basis; and to provide a means for paying irrigation costs to the extent that they cannot be repaid by the water users, applying for that purpose the interest component of pooled power revenues.

The Congress, in the Flood Control Act of 1950, authorized those Columbia River Basin projects included in the joint plan for construction by the Department of the Army's Corps of Engineers, but omitted all the projects jointly recommended for construction by the Department of the Interior's Bureau of Reclamation. It also omitted provisions for establishing the basin account without which the various Federal projects to be constructed in the Basin cannot be combined in a sensible and practical operating system.

The President, in approving the flood-control bill, stated:

> I urge that the Congress reconsider this matter at the earliest opportunity, and authorize the missing pieces of the Army-Interior Columbia Basin plan.

The Flood Control Act of 1950 also authorized the Secretary of the Army to develop comprehensive, integrated plans for improvement of the Arkansas-White, and Red River Basins. In commenting on this authorization in his message of approval, the President stated:

> I shall attempt to assure concerted action and effective planning, so far as that may be accomplished under existing laws. I am therefore issuing instructions to the appropriate Federal agencies to work together in preparing comprehensive plans for these basins, insofar as their existing authority permits, and to invite participation by the States concerned.

An interagency field committee for the Arkansas-White and Red River Basins was established by the Federal Interagency River Basin Committee on June 12, 1950, to coordinate at the field level, work in the comprehensive survey of these basins. The Flood Control Act of 1950 provides an opportunity as well as a responsibility to develop a comprehensive program of resources development, urgently needed by this area. This work will be under way in fiscal year 1951.

The Bureau of Reclamation's comprehensive report on Central Valley Basin, Calif., was transmitted to the Congress early in the fiscal year and printed as Senate Document 113, Eighty-first Congress, first session.

After careful analysis of testimony presented at a public hearing April 3, 1950, the Secretary of the Interior approved construction of Echo Park and Split Mountain Dams for impounding water within Dinosaur National Monument, in connection with development of Colorado River storage project. The project would provide storage for comprehensive development of upper Colorado River Basin. The hearing, called to consider the merits of the two proposed dams, attracted large numbers of proponents from Colorado River Basin States and numerous opponents representing recreational interests.

Work will be furthered in fiscal year 1951 on the United Western Investigation, an important reconnaissance investigation, involving several Western States, initiated late in fiscal year 1949. The investigation is being conducted to ascertain, and to report to the Congress, whether the Bureau of Reclamation should further explore the possibility of bringing surplus water from Columbia River Basin, or elsewhere, by diversion, transfer, or other means, into the Southwest, which is greatly deficient in water supply; and whether, by suitable exchanges, further development can take place in the States within the Colorado River Basin.

Continuing rapid growth of population, industry and agriculture in the Western States is requiring extensive additional developments of local streams, many of which are, or soon will be, fully developed. Ground water supplies essential to the existence of many communities already have been heavily overdrawn. Future growth will be inhibited unless new water supplies can be brought to such dry areas by diversion, transfer, or other means.

NEW PROJECTS AUTHORIZED

The following projects, or units of projects, have been authorized for construction by the Congress: Folsom unit and Sly Park unit, American River division, Central Valley project, California; Weber Basin project, Utah (report printed as S. Doc. 147, 81st Cong., 2d sess.); Fort Sumner project, New Mexico; Buffalo Rapids project, Montana (reauthorized); rehabilitation of pipeline, Grants Pass irrigation district, Deschutes project, Oregon; Middle Rio Grande project, New Mexico, previously "approved" by the Congress.

OTHER PROJECT PLANNING REPORTS

At the end of the fiscal year, the Senate was considering a bill, passed by the House and printed as H. R. 940, to authorize construction of Eklutna project in Alaska. Reclamation's report on the project had been forwarded to the Congress prior to the House action.

A report on initial development of North Fork Kings unit of Kings River division, Central Valley project, California, was submitted to the Congress by the Secretary of the Interior, with recommendations for authorization. It was printed as H. R. 537, Eighty-first Congress, second session.

When the year ended, the Bureau of the Budget was considering Reclamation reports on the following: Alcova power plant, Kendrick project, Wyoming; Canadian River project, Texas; Collbran project, Colorado; North Side pumping division, Minidoka project, Idaho; and Palisades project, Idaho (reauthorization).

RIVER COMPACTS

The President, on March 21, 1950, signed the bill approving the Snake River compact between Idaho and Wyoming, now known as Public Law 464, Eighty-first Congress, second session. This action is expected to clear the way for further developments along Snake River, especially construction of Palisades Reservoir in Idaho.

The States of New Mexico, Oklahoma, and Texas have been authorized to negotiate a compact on the Canadian River, and a Geological Survey representative has been named Federal representative. Legislation was introduced in the Congress to authorize a compact on the Sabine River, but no action was taken during the fiscal year. Negotiations are still under way for the Bear River compact and Cheyenne River compact.

The Upper Colorado River Commission has been active during fiscal year 1950 setting up machinery to implement the upper Colorado compact which went into effect during fiscal year 1949.

Bureau of Reclamation representatives have participated in all these compact negotiations in various capacities.

HYDROLOGY

In addition to its normal hydrologic studies, the Bureau has intensified its planning for river operations particularly in Missouri River Basin and Columbia River Basin. Plans were formulated for better utilization of water for irrigation, improvement and coordination of flood-control operations with the Corps of Engineers, and to form the basis for an operational plan which will be gradually enlarged as new units are constructed. Progress was made on development of improved methods of forecasting runoff from rain and snow.

The Bureau is engaged in an important investigation, in cooperation with the Geological Survey, the Weather Bureau, and the Department of the Navy, to determine the rate of evaporation at Lake Hefner near Oklahoma City, Okla. Techniques of this study will be applied in the precise determination of evaporation at Lake Mead as an aid to operations; and they also will have wide application in planning other western reservoirs and improving studies of water loss by nonbeneficial consumptive use by vegetation.

More adequate and economic spillway design has resulted from improvements and refinements of design flood studies in connection with specific investigation. The improvements and refinements were effected through use of new techniques developed with the aid of storm, unit hydrograph, and infiltration studies.

Looking toward improving the design of diversion works and canals and determining more precisely reservoir storage space allocations, sedimentation studies have been continued with particular attention given to bedload studies of streams in Missouri River Basin. A sedimentation survey of Belle Fourche Reservoir, Belle Fourche project, South Dakota, made during the fiscal year, disclosed that only slightly more than 8 percent of its capacity had been depleted in 42 years. Studies were made and a report prepared showing the effect of all developments existing and proposed on the water supply in Missour River Basin.

INTERNATIONAL STREAMS INVESTIGATIONS

The Bureau participated in the international engineering studies of Kootenai River in Columbia River Basin, and in developing information for use in the preparation of a report to the International Joint Commission on all international aspects of Columbia River.

Engineering work has been advanced on the Waterton-Belly Rivers reference and the Souris-Red Rivers reference made to the International Joint Commission in January 1948. A report on present and future water uses in Waterton and Belly Rivers was submitted to the Commission, and the Commission held public hearings in Montana and Alberta relative to the apportionment between the United States and Canada of the waters of those two streams. Work was started on collection of data that will be needed for preparation of plans of mutual advantage to the two countries as the final phase of the investigations.

Studies of present and future water uses were continued on the Souris and Red Rivers. The devastating floods which occurred on the Red River in May 1950, were the greatest on record and caused increased interest in the control and use of that stream, and acceleration of the international engineering studies now in progress.

DEFINITE PLAN REPORTS

Definite plan reports were completed during fiscal year 1950 for four units of Missouri River Basin project, namely, Fort Clark unit in North Dakota, Keyhole unit in South Dakota and Wyoming, lower Marias unit in Montana, and Owl Creek unit in Wyoming, and for two other projects, including Eden in Wyoming and Fort Sumner in New Mexico. Preliminary drafts of reports on several other projects and units were also prepared.

The Bureau's definite plan reports are those prepared finally for a whole project, or a unit of the project, depending on the size and complexity of the plans recommended for development after authorization of the project.

A brief explanation of how these definite plan reports fit into over-all project planning will not be amiss. Project planning feasibility reports are prepared to present a comprehensive plan for orderly development and conservation of water and related resources, and to ascertain the probable engineering and financial feasibility to enable recommendation for or against work on the plan of a project. Considerable detailed studies and exploratory work usually remain o be done after this stage before sufficient data are available to initi-ate preparation of final plans and specifications.

In some cases, projects are authorized by the Congress before investigations have been completed, documented, and reviewed on the basis of limited data, but are sufficient to support favorable recommendation for authorization of a project. Frequently, there is a fairly long period between authorization and start of actual construction due to lack of funds as well as lack of detailed information. In these instances, there is need for further detailed, documented, and up-to-date information on which to program and develop final plans and specifications for an authorized project, and need for a report on the additional studies, including investigations and negotiations consummated prior to construction. This final report is the definite plan report.

The definite plan report is used by all Bureau administrative officials and technical personnel as the authoritative, detailed plan and specification, and, if favorable, as the basic guide for carrying out plans for proper and orderly development of a project, division, or unit. The report is also important as the basis for scheduling and programing the planning and construction of the project; as the fundamental source of information for budget justifications furnished to the Bureau of the Budget and to congressional committees in support of requests for construction funds, and for other officials and interested agencies; and, as a check to determine the engineering, agricultural, and economic soundness of the plan in its various details of development, or of individual major portions of the plan, before actual construction is undertaken.

OTHER PLANNING ACTIVITIES

The Bureau held its first Reclamation policy conference in fiscal year 1950, with regional and branch directors and other members of the Reclamation Commissioner's immediate staff participating. Results of this conference clearly indicated the value of such meetings, and they will be held annually hereafter in the month of December.

As work progressed on the Missouri River Basin project during the year, it became increasingly apparent that firm criteria needed to be established and used in moving units of the project from the planning stage (phase B) to construction (phase A). To accomplish this, the following criteria have been set up: Approval of the definite plan report by the Reclamation Commissioner; favorable benefit-cost ratio; ability to meet annual costs of operation, maintenance, and replacement by each reimbursable function; and, reimbursement of power costs in 50 years at 3-percent interest, municipal water costs in 50 years at 2-percent interest, and costs of irrigation distribution system in 40 years without interest.

Work With the President's Water Resources Policy Commission

The President's Temporary Water Resources Policy Commission was established by Executive Order No. 10095, dated January 3, 1950, for the purpose of studying and making recommendations on policies that should be followed in federally sponsored development, conservation and use of the Nation's water resources. Since water resource use is closely related to and, in many instances, dependent on the use of other resources, the Commission's assignment involves a large proportion of the field of resource development carried on by the Bureau of Reclamation.

The Bureau, therefore, has worked closely with the Commission since its establishment in its consideration of the extent and character of Federal Government participation in major water-resources programs; an appraisal of the priority of water-resources programs from the standpoint of economic and social need; criteria and standards for evaluating the feasibility of water-resources projects; and, desirable legislation or changes in existing legislation relating to the development, utilization, and conservation of water resources.

PROGRAMS AND FINANCE

Programs and finance work in the Bureau of Reclamation is primarily concerned with administrative coordination and integration of construction program recommendations and decisions, and the establishment and maintenance of accounts, program schedules, financial statements, and progress reports. It thus facilitates the Bureau's control of progress and the financing of all its activities, in accordance with requirements and limitations imposed by statutes and by congressional direction.

New Accounting System

A new accounting system, patterned after the uniform system of accounts prescribed by the Federal Power Commission for public utilities, was devised and has been installed in all the Bureau's accounting offices. This system provides financial information through a commercial-type financial statement, normally rendered to stockholders and directors of large corporations. It embodies the principle of branch-office accounting, providing fund control through reciprocal accounts in the Washington and regional offices, the reciprocal accounts being eliminated on a consolidated statement.

The project is the accounting entity in the new system; properties are accounted for at original cost, operation, and maintenance on an applied cost basis. The system differentiates between capital expenditures and current expense. Expenditures are recorded on an accrual basis; the expenditure is said to accrue when property or services are received.

In the system, classification of accounts is uniform for programing, budgeting, accounting, and subsequent reporting. A system of budgetary control is integrated with the general ledger accounts. Conversion from manual to IBM recapitulation and tabulating of Budget-Treasury Form 3 reduced the time of the operation from weeks to hours. Proceduralizing and installing a work order system to relate current work to the approved program and to select accounts under which costs are to be accumulated, was begun during the fiscal year and will be completed in 1951.

In order to make the new accounting system operative on the date of conversion, certain account balances were converted from the old accounts to the new without analysis. Most important of these is the plant-in-service accounts for which the division of costs between multipurpose irrigation and electric plants could not be determined with reasonable accuracy. Analysis of recorded costs approximating 2.0 billion dollars will continue through fiscal year 1951 looking to complete adjustment and accurate reporting on the Bureau of Reclamation's financial condition by close of the year.

MANUALIZATION OF PROCEDURES

Manualization of procedures progressed satisfactorily during the fiscal year. At the beginning of the year, program procedures for the scheduling, budgeting, and reporting of construction activities for fiscal year 1951 were issued to the field. These procedures were extended during the year to cover general investigations, and manualized drafts were reviewed and cleared by regional officials at the Bureau's first programing conference in June.

On the basis of trial installations in a representative group of field offices, the work order and cost accounting procedures were officially issued in the finance manual. These work order procedures are the basic connecting link between the finance and accounting procedures on the one hand, and the program, budget, and reporting procedures on the other.

Manualized drafts covering the program aspects of the work order procedures have been completed, and will be issued early in fiscal year

1951. A survey was also initiated to develop a higher degree o integration between the work order procedures and the procedures fo construction and procurement scheduling, payrolls, property accounting, and progress reporting.

Manualized procedures were issued for movable property accounting, retirement accounting, fund control, billing and collections, trave plant-in-service accounts, irrigation operation and maintenanc accounts, municipal water supply accounts, and accounting for purchases made through the Bureau of Federal Supply. Procedure covering a complete system of financial reports and statements wer also issued in manual form.

Further simplication and refinement of both program and financ procedures will be made possible by the simplified appropriatio structure provided for in the pending appropriation bill for fiscal yea 1951.

During the year, more than 175 forms and reports were eliminated making a total of 225 such eliminations in fiscal year 1949 and 195 and indicating a high rate of progress in simplification and consolidation of reporting procedures. Further work in this direction is a objective for fiscal year 1951.

PROGRAMING COORDINATION

Programing of Bureau operations to assure coordination of al activities for the orderly and efficient achievement of predetermine objectives and to furnish essential administrative control had bee well established at start of the fiscal year in connection with construction projects. During the year, programing procedures were expande to cover operation and maintenance and general investigation activities. By year's end these were operating on a preliminary basis.

Applying experience gained during previous years to the over-al programing procedures, considerable improvement was achieved i the form of submittal and detail of information required. A majo step in this direction was made by combining two forms previousl used into one master form, thereby greatly reducing the amount o material prepared and submitted. A simplified procedure for revising programs was inaugurated, resulting in reduced paper work and the maintenance of more realistic and sensitive schedules. Instructions for preparation and submittal of program documents, previousl issued as administrative letters, were in process of manualization considerable material having been issued in final form.

While it is recognized that refinements based on further experience, especially in the new fields covered, will be required, it is believed that the major task in formalizing program procedures has been accomplished.

TABLE 12.—*Bureau of Reclamation—schedule of advance construction program, fiscal years*

Name and location of divisions or projects	Total estimated cost	Obligations to June 30, 1950	Program of obligations							
			1951	1952	1953	1954	1955	1956	1957	Balance to complete
CONTINUING DIVISIONS OR PROJECTS										
All-American Canal, Ariz.-Calif.	$67,647,073	$57,813,282	$1,953,282	$2,837,700	$1,913,286	$2,353,124	$15,000	$15,000	$15,000	$730,988
Arnold, Oregon	207,150	184,360	22,790							
Austin, W. C., Oklahoma	13,206,000	12,467,162	263,401	177,000	139,000	129,000	63,226			−42,789
Boise-Anderson Ranch, Idaho	30,714,100	29,439,687	1,098,963	175,450						
Boise-Kuna, Idaho	160,000	33,684	2,000	2,000						122,316
Boise-Payette, Idaho	17,173,000	15,976,339	696,661	450,000	50,000					
Boulder Canyon, Hoover Dam, Ariz.-Nev.	173,900,000	154,721,524	9,280,147	3,499,346	1,120,608	2,875,000	2,301,965	101,410		
Buffalo Rapids, First Division, Montana	2,735,000	1,922,149	185,726	260,090	224,000	143,035				
Buffalo Rapids, Second Division, Montana	2,638,000	1,973,118	147,202	77,672	167,023	167,549	101,564	3,872		
Cachuma, Calif.	31,520,000	4,654,079	8,923,283	13,016,000	5,095,138	−168,500				
Carlsbad, N. Mex.	2,600,000	2,544,006	47,226							8,768
Central Valley, Calif.	599,583,600	319,963,142	43,376,002	44,146,691	55,236,294	50,523,909	25,322,146	10,244,397	1,943,655	48,827,364
Colorado-Big Thompson, Colorado	150,165,000	96,789,617	17,219,469	28,000,000	7,720,000					435,914
Colorado River Front Work and Levee System, Arizona-California-Nevada.	12,504,000	4,938,927	674,939	4,271,572	2,618,562					
Columbia Basin, Wash.	715,100,000	368,695,001	47,338,126	30,519,872	20,050,000	11,350,000	9,350,000	6,800,000	7,700,000	213,297,001
Davis Dam, Ariz.-Nev.	114,438,000	89,513,364	15,116,429	8,696,683	864,447	247,077				
Deschutes-North unit, Oregon	12,850,000	11,567,452	564,295	315,753	30,000	25,000	20,000	20,000		307,500
Eden, Wyo.	6,393,800	694,311	1,350,498	2,546,943	1,003,642	517,162	281,244			
Fort Peck, Mont.	14,820,000	6,385,671	2,249,356	1,693,000	277,000	280,000	325,000	585,000	858,000	2,166,973

TABLE 12.—*Bureau of Reclamation—schedule of advance construction program, fiscal years 1951–57, authorized projects*—Continued

Name and location of divisions or projects	Total estimated cost	Obligations to June 30, 1950	Program of obligations							
			1951	1952	1953	1954	1955	1956	1957	Balance to complete
Fort Sumner, N. Mex.	$2,464,000	$795,819	$1,706,685	$64,000						−$102,504
Gila, Ariz.	53,968,541	21,320,718	5,548,081	7,870,000	$5,565,000	$4,200,000	$2,963,000	$1,802,000	$1,110,000	3,589,742
Grand Valley, Colo.	5,245,443	4,993,226	2,300	617						249,300
Grants Pass, Oreg.	100,000	94,498	5,502							
Hungry Horse, Mont.	108,800,000	39,248,441	28,900,000	22,975,000	14,000,000	4,036,559	−360,000			
Kendrick, Wyo.	32,262,000	21,513,792	[2] 2,521,771	4,371,000	2,300,000	1,200,000	274,587	80,850		
Kern River, Calif.	125,000	2,828	39,672	75,000	75,000					
Kings River, Calif.	300,000	209,058	18,000	48,867	24,075					
Klamath, Oreg.-Calif.	18,327,651	12,992,690	921,391	449,482	238,088					3,726,000
Lewiston Orchards, Idaho	2,500,000	2,290,966	209,034							
Milk River, Fresno Dam, Mont.	2,000,000	1,793,819	57,407							148,774
Minidoka, Gooding, Idaho	6,676,186	6,625,331	15,707	30,398						4,750
Missouri River Basin—various	3,124,338,300	179,777,539	88,292,285	110,384,843	133,021,098	175,211,202	193,636,076	191,413,680	189,302,547	1,863,299,030
Ochoco, Oreg.	961,556	834,479	3,077	124,000						
Ogden River, Utah	4,753,540	4,712,830	40,710							
Palisades, Idaho	76,601,000	3,313,901	[2] 4,272,737	10,000,000	13,651,000	17,434,983	15,200,000	6,755,000	4,403,352	1,570,027
Paonia, Colo.	6,432,700	1,387,209	581,581	1,019,528	2,276,500	1,167,882				
Parker Dam Power, Ariz.-Calif.	23,718,659	23,706,573	12,086							
Preston Bench, Idaho	449,140	448,140	1,000							
Provo River, Utah	30,960,000	22,808,398	4,406,325	2,750,000	995,277					
Rehabilitation and betterment—various	39,451,928	2,887,242	4,106,629	4,100,000	4,261,656	4,202,135	4,209,724	3,874,200	3,410,000	8,400,342

Rio Grande, Elephant Butte Power, New Mexico-Texas.	14,800,224	12,661,060	1,051,056	1,088,108	-----	-----	-----	-----	-----	-----
Riverton, Wyo	24,215,000	15,737,300	2,363,195	4,306,710	1,273,236	398,863	93,577	42,119	-----	-----
San Luis Valley, Colo	45,146,000	2,433,128	2,396,282	633,000	342,000	10,210,000	10,460,000	10,610,000	3,464,125	4,597,465
Shoshone, Wyo	16,851,547	13,631,038	615,630	280,752	149,424	124,953	195,000	116,582	-----	1,738,168
Sun River, Greenfields, Mont	9,597,449	9,404,491	39,000	40,436	57,100	34,000	22,422	-----	-----	-----
Tucumcari, N. Mex	16,731,500	15,540,432	347,294	244,000	157,500	442,274	-----	-----	-----	-----
Valley Gravity, Tex	126,552,000	1,433,417	9,000	3,000	3,000	3,000	3,000	3,000	3,000	125,091,583
Water conservation and utilization	11,931,675	11,845,205	86,470	-----	-----	-----	-----	-----	-----	-----
Yakima-Kennewick, Wash	10,736,000	765,272	168,017	1,550,000	4,580,711	3,104,000	531,000	17,000	8,000	12,000
Yakima-Roza, Wash	22,868,000	20,717,252	248,562	855,000	1,028,128	19,058	-----	-----	-----	-----
Subtotals continuing divisions or projects.	5,808,219,762	1,636,202,967	299,496,692	313,949,513	280,440,293	290,241,265	265,008,531	232,484,110	212,217,679	2,278,178,712
NEW DIVISIONS OR PROJECTS										
Eklutna, Alaska	20,365,400	44,154	[2] 1,104,000	5,761,400	5,555,000	7,087,000	813,846	-----	-----	-----
Middle Rio Grande, N. Mex	30,179,000	265,626	[1] 298,000	1,250,000	11,769,000	5,231,500	3,041,000	2,843,900	2,220,000	3,259,974
Minidoka, American Falls Power, Idaho	6,600,000	328,274	[2] 160,000	2,000,000	2,974,726	1,137,000	-----	-----	-----	-----
Minidoka, North Side pumping, Idaho	10,377,000	520,924	489,492	1,505,500	1,473,000	1,704,000	918,000	654,000	654,000	2,458,084
Solano, Calif	45,577,000	178,997	[1] [2] 866,000	6,441,000	14,256,000	14,518,003	3,277,000	6,040,000	-----	-----
Vermejo, N. Mex	2,679,000	117,050	[2] 40,000	482,000	996,500	707,950	217,500	-----	-----	118,000
Weber Basin, Utah	69,534,000	522,361	[1] 369,000	1,225,000	7,738,639	10,090,000	8,731,000	6,263,000	5,275,000	29,320,000
Subtotals new divisions or projects	185,311,400	1,977,386	3,326,492	18,664,900	44,762,865	40,475,453	16,998,346	15,800,900	8,149,000	35,156,058
Totals authorized divisions and projects.	5,993,531,162	1,638,180,353	302,823,184	332,614,413	325,203,158	330,716,718	282,006,877	248,285,010	220,366,679	2,313,334,770

See footnotes at end of table.

TABLE 12.—*Bureau of Reclamation—schedule of advance construction program, fiscal years 1951–57, authorized projects*—Continued

Name and location of divisions or projects	Rate of power development—kilowatts (in thousands)									Rate of irrigation development—acres (in thousands)									
	Existing June 30, 1950	1951	1952	1953	1954	1955	1956	1957	Estimated additional		Existing June 30, 1950	1951	1952	1953	1954	1955	1956	1957	Estimated additional
CONTINUING DIVISIONS OR PROJECTS																			
All American Canal, Ariz.-Calif										F	442.5	24.1	7.1	6.5	120				
										S	9.1	11.8	.9	1.9					
Arnold, Oregon										F									
										S									
Austin, W. C., Oklahoma										F									
										S	48.0								
Boise-Anderson Ranch, Idaho		27.0								F									
										S		300.0							
Boise-Kuna, Idaho										F									
										S									
Boise-Payette, Idaho										F	52.8								
										S									
Boulder Canyon, Hoover Dam, Ariz.-Nev.	1,034.8		215.0				82.5			F									
										S									
Buffalo Rapids, First Division, Montana										F	14.2	1.5							
										S									
Buffalo Rapids, Second Division, Montana										F	11.6								
										S									
Cachuma, Calif										F									
										S				29.7					
Carlbad, N. Mex										F	21.0								
										S									
Central Valley, Calif	450.0					65.0	200.0	180.0		F	13.8	3.4	17.0	80.0	80.0	80.0	60.0	59.0	104.0
										S	291.1	167.3	10.0	90.0	90.0	90.0	20.4		
Colorado-Big Thompson, Colorado	21.6	53.1		96.3					6.7	F									
										S	24.0		206.0	58.0	122.0	205.0			
Colorado River Front Work and Levee System, Ariz.-Calif.-Nev.										F									
										S									
Columbia Basin, Wash	1,424.0	334.02	16.0							F	6.8		67.8	59.6	52.7	52.8	53.8	51.3	684.1
										S									
Davis Dam, Ariz.-Nev		225.0								F									
										S									
Deschutes-North unit, Oregon	1.5									F	50.0								
										S	46.0								

Eden, Wyo										F				5.0	5.0	5.0	5.0		
										S									
Fort Peck, Mont										F									
										S									
Fort Sumner, N. Mex										F									
										S		6.5							
Gila, Ariz										F	20.1			7.4	8.5	14.0	14.0	14.9	13.9
										S	1.0	7.0		3.7	3.7				7.0
Grand Valley, Colo										F	38.5								1.1
										S									
Grants Pass, Oreg										F									
										S									
Hungry Horse, Mont				142.5	142.5					F									
										S									
Kendrick, Wyo	32.4				36.0					F	7.0	2.0	2.0	2.0	2.0	2.0	3.0		
										S									
Kern River, Calif										F									
										S									
Kings River, Calif										F									
										S									
Klamath, Oreg.-Calif										F	148.6			6.0					23.8
										S	44.1								
Lewiston Orchard, Idaho										F									
										S									
Milk River, Fresno Dam, Mont										F	123.0								
										S									
Minidoka, Gooding, Idaho										F	92.0								
										S	8.0								
Missouri River Basin—various	12.0	24.0	16.2		50.0	44.0	48.0	153.0	700.2	F	2.2		40.2	31.6	86.4	80.0	137.5	130.9	4,830.2
										S	2.8			72.8	.5	16.6	18.3	50.4	975.1
Ochoco, Oreg										F									
										S									
Ogden River, Utah										F	4.0								
										S	16.6								
Palisades, Idaho							22.5	45.0	45.0	F									
										S								650.0	
Paonia, Colo										F		.5	1.7						
										S		5.0	7.8		2.0				
Parker Dam Power, Ariz.-Calif	120.0									F									
										S									
Preston Bench, Idaho										F									
										S	4.1								
Provo River, Utah										F									
										S	46.2	6.0	4.0						
Rehabilitation and betterment—various.										F									
										S									
Rio Grande, Elephant Butte Power, New Mex.-Tex.	24.3									F									
										S									
Riverton, Wyo	1.6									F	58.8	6.9		6.8	7.6	8.8	8.2		
										S									

See footnotes at end of table.

TABLE 12.—*Bureau of Reclamation—schedule of advance construction program, fiscal years 1951–57, authorized projects*—Continued

Name and location of divisions or projects	Rate of power development—kilowatts (in thousands)										Rate of irrigation development—acres (in thousands)								
	Existing June 30, 1950	1951	1952	1953	1954	1955	1956	1957	Estimated additional		Existing June 30, 1950	1951	1952	1953	1954	1955	1956	1957	Estimated additional
San Luis Valley, Colo										F									
										S			73.9	12.3				220.1	249.7
Shoshone, Wyo	10.6									F	107.5								7.5
										S									
Sun River, Greenfields, Mont										F	83.0								
										S									
Tucumcari, N. Mex										F	42.3								
										S									
Valley Gravity, Tex										F									
										S									522.0
Water conservation and utilization										F	27.5	.6	.2	.1					
										S	55.5								
Yakima-Kennewick, Wash					9.6					F					1.4	15.3			
										S					4.3				
Yakima-Roza, Wash					10.0					F	72.0								
										S									
Subtotals continuing divisions or projects.	3,132.8	663.1	447.2	238.8	248.1	109.0	353.0	378.0	751.9	F	1,436.2	39.0	135.9	205.0	255.6	257.9	281.5	247.1	5,664.6
										S	596.5	503.6	302.6	268.4	222.5	311.6	38.7	920.5	1,783.8
NEW DIVISIONS OR PROJECTS																			
Eklutna, Alaska						30.0				F									
										S									
Middle Rio Grande, N. Mex										F									
										S									
Minidoka, American Falls Power, Idaho.					30.0					F									
										S									
Minidoka, North Side pumping, Idaho										F	1.3	3.8	5.0	8.0	8.0	8.0	8.0	8.0	27.6
										S									
Solano, Calif										F					2.0	20.0	4.0		47.6
										S							5.0		
Vermejo, N. Mex										F				1.0	2.0	4.2			
										S									
Weber Basin, Utah									2.0	F						3.0	4.0		63.0
										S						2.0	6.0		22.0
Subtotals new divisions or projects.					30.0	30.0			3.0	F	1.3	3.8	5.0	9.0	12.0	35.2	16.0	8.0	138.2
										S						2.0	11.0		22.0
Totals authorized divisions and projects.	3,132.8	663.1	447.2	238.8	278.1	139.0	353.0	378.0	754.9	F	1,437.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
										S	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[1] Program for fiscal year 1951 being financed in part or in full from advanced planning funds provided by general investigations appropriation.

[2] Program for fiscal year 1951 being financed or to be financed in part or in full from supplemental funds appropriated or requested during the year.

F=Full irrigation supply.
S=Supplemental irrigation supply.

Statement of advance planning and supplemental funds, fiscal year 1951

Division or project	Advance planning funds [1]		Supplemental funds [2]	
	Fiscal year 1950 carry-over	Appro-priated	Appro-priated	Requested
Eklutna, Alaska			$1, 100, 000	
Kendrick, Alcova power plant, Wyoming				$650, 000
Middle Rio Grande, N. Mex		$298, 000		
Minidoka, American Falls, Idaho				125, 000
Palisades Idaho				4, 000, 000
Solano, Calif		321, 000		545, 000
Vermejo, N. Mex				40, 000
Weber Basin, Utah	$48, 000	321, 000		
Yakima, Kennewick, Wash	8, 017	160, 000		
Total	56, 017	1, 100, 000	1, 100, 000	5, 360, 000

The new procedures, to a much greater degree than previously, tie the programing documents to the accounting system and budgeting procedures, thus more closely approaching the ultimate goal of a completely coordinated system of estimates, programs, reports, and accounts. The revised procedures emphasize the interdependence of the various program and finance activities and reflect the close coordination developed within the organization. This coordination has made possible the submittal of program schedules covering a considerably increased field within the same time limits previously established for the more limited operation concerned with construction only. Establishment of a work order system as a link between the program schedule and the accounting system greatly facilitated this coordination.

Another major step toward more efficient preparation of realistic programs was taken with inauguration of annual programing conferences, which will be held hereafter in June of each year. At the first conference in June 1950 proposed schedules for the current and budget year were reviewed by representatives of all concerned Bureau subdivisions prior to their submittal to the Commissioner of Reclamation for approval. Experience gained at this conference indicates that coordination of the objectives of the various offices and branches will be more readily achieved, and revisions of the program during the year will be held to a minimum by continuation of this procedure.

APPROPRIATIONS

The Bureau of Reclamation's regular and supplemental appropriations for fiscal year 1950 amounted to $358,308,510, an increase of $91,535,964 over fiscal year 1949. With the unused balance of $35,518,017 from the previous year, the money available for Reclamation totaled $393,826,527.

The unobligated funds at the end of fiscal year 1950, carried over into fiscal year 1951, totaled 57.7 million dollars, considerably larger than the regular 10 percent usually allowed as a provision against contingencies, and frequently carried over. This larger carry-over resulted principally from a return of competition in the construction field, due in part to increased labor efficiency resulting in bids considerably lower than the estimates.

Another factor having a bearing on the carry-over balance was the uncertainty about appropriations during the entire first quarter of the year. This was occasioned by delay in the passage of the 1950 appropriation bill, which was given final approval on October 12, 1949.

In spite of these conditions, obligations for fiscal year 1950 totaled 336.1 million dollars or 85.3 percent of the work programed in 1950, as compared with 88.5 percent accomplished in fiscal year 1949, and 88 percent in fiscal year 1948.

The 1949 Appropriation Act imposed certain restrictions on the Bureau, one of which limited the amount of construction work which could be performed by Government forces (force account work). The act decreed that the amount of work these forces could perform could not exceed 8 percent of the appropriation for any one project, with a maximum of $200,000 that could be so used. This restriction was modified by the First Deficiency Appropriation Act of 1949 to allow 12 percent of the appropriation of any one project for force account work. A similar limitation appeared in the Interior Department Appropriation Act, 1950, but with a further modification increasing the maximum amount which may be used on any project to $225,000.

Another restriction appearing in the 1949 Appropriation Act was the limitation of $7,800,000 placed upon design work performed by the Bureau's central design office at Denver. This restriction was raised to $9,250,000 by the First Deficiency Appropriation Act of that year and was eliminated in the Interior Department Appropriation Act, 1950.

A $50,000 limitation in the salaries and expenses appropriation was imposed upon expenditures for informational work during the fiscal year 1949. While a similar limitation was again imposed in 1950, the amount allowed for this work was raised to $150,000.

Restrictions limiting the amount which could be expended for personal services to $48,000,000, and the number of employees in grades CAF–9 and P–3 and above to 3,500 appearing in the Interior Department Appropriation Act, 1949, were increased to $54,500,000 and 3,625, respectively, in the First Deficiency Appropriation Act, 1949. These, together with other minor personnel restrictions, were not continued in the Interior Department Appropriation Act, 1950.

The budget submissions for fiscal year 1951 were presented to the Bureau of the Budget and the Congress in conformity with the new appropriation structure as recommended by the House Appropriations Committee. This new presentation simplifies the budget submission because the multifarious activities of the Bureau are grouped into only four major appropriations, namely, general investigations, construction and rehabilitation, operation and maintenance, and general administrative expenses, with specified amounts to be derived from the Reclamation fund, the Colorado River Dam fund, and the Colorado River development fund.

It is anticipated that requests for deficiency and supplemental appropriations will be minimized somewhat as a limited interchange of funds within the appropriation will be permitted in cases of real emergency; only, however, with the approval of the Secretary of the Interior who is charged with the responsibility of carrying out the intent of Congress with respect to allocations.

The amount appropriated, including all supplementals for fiscal year 1950 for each activity, is as follows:

TABLE 13.—*Condensed statement of appropriations, fiscal year 1950, exclusive of trust funds*

Appropriation		Amount
Reclamation fund, special fund:		
Salaries and expenses		$4,365,100
General investigations		3,700,000
Investigations, Upper Colorado River Basin		500,000
Advance planning, Yakima project, Washington, Kennewick division		50,000
Construction		21,853,063
Operation and maintenance, direct appropriation (irrigation)	$2,455,975	
Operation and maintenance, power revenues	9,327,097	
Operation and maintenance, total		11,783,072
Rehabilitation and betterment of existing projects		2,500,000
Total, Reclamation fund, special fund (includes appropriation from power revenues)		44,751,235
General fund:		
Alaskan investigations		200,000
Construction [1]		311,234,175
Total, general fund		311,434,175
Colorado River Dam fund:		
Colorado River development fund (expenditure account)		500,000
Boulder Canyon, operation and maintenance		1,623,100
Total, Colorado River Dam fund		2,123,100
Total, general and special funds (includes appropriations from power revenues)		358,308,510

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[1] In addition, Appropriation Act permits contract authorization of $975,700 for All-American Canal, Arizona-California, $1,000,000 for Fort Sumner project, New Mexico; and $6,364,000 for Missouri River Basin project.

Funds made available to the Bureau from its inception to date are shown in table 14. From 1902 to 1915 the amounts shown were authorized by Secretarial action from the Reclamation fund, consisting of money from public land sales and other sources. Subsequent amounts were appropriated by Congress.

TABLE 14.—*Allotments from Reclamation fund, 1902–15, appropriations from Reclamation and general funds, 1916–50, and emergency fund allocations (NIRA, PWA, and ERA)*

Fiscal year	Allotments from Reclamation fund	Appropriations from Reclamation and general fund [1]	Emergency fund allocations (NIRA, PWA and ERA)	Total funds available for expenditure
1903	*$855,000			*$855,000
1904	*18,200,000			*18,200,000
1905	*8,758,000			*8,758,000
1906	* [3] −9,711,173			* [3] −9,711,173
1907	*15,211,407	[4] $1,000,000		*16,211,407
1908	*10,011,765			*10,011,765
1909	*10,378,950			*10,378,950
1910	*8,504,050			*8,504,050
1911	24,722,790			24,722,790
1912	7,286,000			7,286,000
1913	6,229,000			6,229,000
1914	9,764,166			9,764,166
1915	11,742,042			11,742,042
1916		13,530,000		13,530,000
1917		8,902,557		8,902,557
1918		8,537,213		8,537,213
1919		9,840,277		9,840,277
1920		7,848,927		7,848,927
1921		9,124,177		9,124,177
1922		20,601,871		20,601,871
1923		15,359,530		15,359,530
1924		12,564,067		12,564,067
1925		13,640,809		13,640,809
1926		12,363,240		12,363,240
1927		7,556,320		7,556,320
1928		12,203,800		12,203,800
1929		14,443,400		14,443,400
1930		8,743,000		8,743,000
1931		20,242,000		20,242,000
1932		22,371,000		22,371,000
1933		25,866,953		25,866,953
1934		11,456,335	$87,205,098	98,661,433
1935		1,176,750	30,523,787	31,700,537
1936		15,438,100	36,883,746	52,321,646
1937		56,444,600	1,646,362	58,090,962
1938		42,417,600	31,089,515	73,507,115
1939		45,410,600	2,376,654	47,787,254
1940		78,165,600	2,715,032	80,880,632
1941		74,533,600	13,514	74,547,114
1942		102,776,031	24,824	102,800,855
1943		91,663,670		91,663,670
1944		41,610,575		41,610,575
1945		27,434,000		27,434,000
1946		120,943,650		120,943,650
1947		119,631,088		119,631,088
1948		143,185,038		143,185,038
1949 [2]		266,772,546		266,772,546
1950		358,308,510		358,308,510

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[1] Includes power revenue authorizations.

[2] Does not include sums totaling $560,197 contained in 1947 and 1948 Appropriations Acts rescinded from Fort Peck project under title II of 1949 act.

[3] Negative amounts reflect partial invalidation of previous allotments.

[4] Nonreimbursable appropriation for Rio Grande, act of Mar. 4, 1907.

* Calendar year.

Funds available for appropriation from the Reclamation fund, and actual and estimated appropriations therefrom for fiscal years 1949–51, are shown in the following tabulation:

TABLE 15.—*The Reclamation fund, 1949–51, funds available for appropriation*

	Actual, 1949	Actual, 1950	Estimated, 1951
Unappropriated balance brought forward (as of June 30)	$34, 759, 576	$41, 128, 209	$32, 136, 457
Accretions and collections:			
Reclamation fund, collections:			
Bureau of Reclamation, 100	8, 027, 430	9, 251, 558	[1] 10, 417, 500
Other agencies, 200	19, 380, 276	10, 041, 395	19, 698, 500
Reclamation fund, power revenues, 300	15, 921, 773	17, 023, 785	[2] 33, 052, 570
Total accretions and collections	43, 329, 479	36, 316, 738	63, 168, 570
Total available for appropriation	78, 089, 055	77, 444, 947	95, 305, 027
Less:			
Appropriated for refund of revenue collections	----------	14, 985	----------
Appropriated collections returned to receipts	----------	672, 066	----------
Add: Lapsed appropriations	----------	129, 796	----------
Deduct appropriation or estimate for			
General investigations	3, 500, 000	3, 700, 000	5, 116, 000
Investigations, upper Colorado River Basin	----------	500, 000	----------
Advance planning	----------	50, 000	----------
Construction and rehabilitation	----------	----------	25, 135, 700
Construction	18, 250, 810	21, 853, 063	----------
Rehabilitation and betterment of existing projects	1, 500, 000	2, 500, 000	----------
Operation and maintenance	8, 841, 454	11, 783, 072	12, 001, 400
General administrative expenses	----------	----------	7, 200, 000
Salaries and expenses	3, 868, 582	4, 365, 100	----------
Emergency fund	1, 000, 000	----------	----------
Total appropriation or estimate	36, 960, 846	44, 751, 235	49, 453, 100
Balance carried forward	41, 128, 209	32, 136, 457	45, 851, 927

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[1] Includes estimated advances by water users.

[2] Includes estimated revenues of $11,322,570 from Bonneville Power Authority.

The following table shows accretions to the Reclamation fund during fiscal years 1949 and 1950, by States:

TABLE 16.—*Accretions to Reclamation fund by States, fiscal year 1949*

States	Sale of public lands		Proceeds from Oil Leasing Act		Total to June 30, 1949
	Fiscal year 1949	To June 30, 1949	Fiscal year 1949	To June 30, 1949	
Alabama	$4,372.65	$4,372.65	$501.65	$198,914.80	$203,287.45
Arizona	29,231.66	2,806,814.41	25,674.03	46,947.43	2,853,761.84
Arkansas			660.64	2,053.34	2,053.34
California	140,113.42	8,474,314.14	5,599,076.03	36,778,750.85	45,253,064.99
Colorado	112,240.80	10,446,739.63	2,672,755.57	6,407,247.84	16,853,987.47
Florida			115.50	126.00	126.00
Idaho	25,737.87	7,089,726.88	103,990.15	156,280.51	7,246,007.39
Kansas	647.52	1,035,214.64	18,390.74	97,835.13	1,133,049.77
Louisiana			19,008.65	404,890.15	404,890.15
Michigan			2,236.93	7,929.44	7,929.44
Mississippi			481.29	1,577.60	1,577.60
Montana	67,401.03	15,465,314.90	835,962.59	4,130,927.07	19,596,241.97
Nebraska	2,457.17	2,102,265.01	330.75	850.50	2,103,115.51
Nevada	25,757.84	1,070,281.20	15,732.15	61,738.37	1,132,019.57
New Mexico	61,899.47	6,822,362.23	3,389,970.90	12,292,705.83	19,115,068.06
North Dakota	7,523.26	12,227,640.39	14,642.82	356,064.81	12,583,705.20
Oklahoma	4,095.48	5,936,123.38	9,402.27	33,516.60	5,969,639.98
Oregon	38,589.75	12,036,748.72	4,626.32	9,101.23	12,045,849.95
South Dakota	4,062.78	7,738,663.81	3,693.51	44,054.21	7,782,718.02
Utah	55,705.51	4,456,620.43	716,997.23	2,821,024.42	7,277,644.85
Washington	52,159.06	7,533,165.89	1,346.50	47,755.40	7,580,921.29
Wyoming	145,888.11	8,883,805.33	7,795,269.69	59,304,644.21	68,188,449.54
Total	777,883.38	114,130,173.64	21,230,865.91	123,204,935.74	237,335,109.38
Proceeds, Federal water-power licenses					[1] 1,129,038.60
Proceeds, potassium royalties and rentals					[2] 3,291,133.61
Receipts from naval petroleum reserves, 1920–38, act of May 9, 1938					29,778,300.23
Proceeds from rights-of-way over withdrawn lands, act of July 19, 1919					[3] 4,762.71
Grand total					271,538,344.53

[1] Proceeds for fiscal year, $32,736.02.

[2] Proceeds for fiscal year, $36,475.67.

[3] Proceeds for fiscal year, $467.92.

Accretions to Reclamation fund by States, fiscal year 1950

States	Sale of public lands		Proceeds from Oil Leasing Act		Total to June 30, 1950
	Fiscal year 1950	To June 30, 1950	Fiscal year 1950	To June 30, 1950	
Alabama		$4, 372. 65	$97. 65	$199, 012. 45	$203, 385. 10
Arizona	$42, 345. 75	2, 849, 160. 16	19, 451. 85	66, 399. 28	2, 915, 559. 44
Arkansas			692. 99	2, 746. 33	2, 746. 33
California	160, 106. 76	8, 634, 420. 90	2, 676, 207. 91	39, 454, 958. 76	48, 089, 379. 66
Colorado	69, 781. 36	10, 516, 520. 99	1, 553, 176. 42	7, 960, 424. 26	18, 476, 945. 25
Florida				126. 00	126. 00
Idaho	114, 562. 61	7, 204, 289. 49	11, 826. 34	168, 106. 85	7, 372, 396. 34
Kansas	2, 510. 66	1, 037, 725. 30	10, 209. 60	108, 044. 73	1, 145, 770. 03
Louisiana			9, 124. 14	414, 014. 29	414, 014. 29
Michigan			1, 537. 41	9, 466. 85	9, 466. 85
Mississippi			547. 96	2, 125. 56	2, 125. 56
Montana	81, 746. 03	15, 547, 060. 93	355, 044. 84	4, 485, 971 91	20, 033, 032. 84
Nebraska	23, 372. 12	2, 125, 637. 13	2, 027. 29	2, 877. 79	2, 128, 514. 92
Nevada	23, 715, 85	1, 093, 997. 05	15, 806. 21	77, 544. 58	1, 171, 541. 63
New Mexico	82, 572. 44	6, 904, 934. 67	1, 565, 108. 83	13, 857, 814. 66	20, 762, 749. 33
North Dakota	11, 192. 89	12, 238, 833. 28	6, 198. 11	362, 262. 92	12, 601, 096. 20
Oklahoma	11, 383. 40	5, 947, 506. 78	13, 381. 10	46, 897. 70	5, 994, 404. 48
Oregon	305, 124. 11	12, 341, 872. 83	29. 24	9, 130. 47	12, 351, 003. 30
South Dakota	4, 164. 02	7, 742, 827. 83	4, 137. 18	48, 191. 39	7, 791, 019. 22
Utah	40, 749. 13	4, 497, 369. 56	208, 974. 08	3, 029, 998. 50	7, 527, 368. 06
Washington	138, 404. 43	7, 671, 570. 32	475. 96	48, 231. 36	7, 719, 801. 68
Wyoming	197, 043. 34	9, 080, 848. 67	2, 717, 843. 88	62, 022, 488. 09	71, 103, 336. 76
Total	1, 308, 774. 90	115, 438, 948. 54	9, 171, 898. 99	132, 376, 834. 73	247, 815, 783. 27
Proceeds, Federal water-power licenses					[1] 1, 165, 480. 17
Proceeds, potassium royalties and rentals					[2] 3, 401, 454. 36
Receipts from naval petroleum reserves, 1920-38, act of May 9, 1938					29, 778, 300. 23
Proceeds from rights-of-way over withdrawn lands, act of July 19, 1919					[3] 10, 401. 79
Grand total					282, 171, 419. 82

Proceeds for fiscal year, $36, 441. 57.

[2] Proceeds for fiscal year, $110,320.75.

[3] Proceeds for fiscal year, $5,639.08.

REPORTS

The Bureau's established reporting system, covering prescribed recurring and special financial, personnel and power statistical and progress reports and publications required within the outside Bureau offices, was rounded out during the fiscal year by the inclusion of a group of interpretative summary reports. These now serve as instruments for administrative purposes.

The Summary Progress Report, correlating the approved scheduled construction program with the newly established accounting and work order system, was fully established. It includes monthly and cumulative accomplishment data and monthly revisions, if any, in estimated value of work projected over the balance of the year beyond the report month. Provisions have been made to adapt this report to other Bureau programed activities in the ensuing fiscal year. The recurring monthly report, giving data on current, cumulative and anticipated contractors' earnings on each construction project, was continued.

The Monthly Fund and Cost Data Digest was inaugurated in November 1949. It is a comprehensive summary of teletyped report data from the regional offices pertinent to the Bureau's all-inclusive construction program. It evaluates accomplishments with respect to scheduled work, appraises the utilization of funds, and is complete with comments on headline items for each construction project under way. This report was extended in June 1950 to include all other programed activities of the Bureau. It is made available to the Bureau's top-management by the 15th of the month following the report month.

Utilizing data from Monthly Fund and Cost Data Digest as well as other basic report data, a series of program accomplishment memorandums were developed during the year. Purpose of these is to pinpoint condition detrimental to efficient operations and to direct attention to corrections or improvements in construction program performances.

Tabulations of month-to-month estimates of year-end carry-over of unobligated construction funds were furnished monthly to officials concerned for scrutiny. Through these tabulations officials were enabled more readily to make determinations for use of available funds to achieve the set program goals. Additional tables on estimates of unliquidated obligations at the year end were provided for measuring progress and for fiscal year 1951 programing.

A trial run of the new Activity and Object Expenditures Report was undertaken prior to the year's end. This report, designed to give Bureau officials necessary information pertinent to costs of basic activities into which the Bureau's work is divided, for administrative and budget preparation, will be fully established in fiscal year 1951.

Throughout the year, regular and special reports and charts on Bureau employment, its trends and forecasts, from a low of 15,545 full-time employees to a high of 18,962, were furnished and adequate controls maintained.

Three ready-reference books, data for which were compiled in fiscal year 1949, were published or otherwise issued during the year. These include volumes entitled, respectively, "Bureau of Reclamation Project Feasibilities and Authorizations," "Bureau of Reclamation Public Notices," "Bureau of Reclamation Project Finance Data, Part I." Partial release of part II of the latter volume was also issued. Data were compiled for a 1950–56 estimated-program publication, planned for issuance in fiscal year 1951.

COMPTROLLER

The office of the Comptroller continued consultative and advisory assistance to the Commissioner of Reclamation and his top staff; review and approval of proposed accounting procedures and other system elements; and performance of independent financial audits of Bureau projects, water users' associations, contract settlements, and other features of Bureau operations.

This office has effected a more complete integration of the Comptroller's financial policy responsibilities with the total Bureau program; specifically, in matters of repayment contract negotiations, analysis of rate schedules, furtherance of problems of municipal finance and management, special studies of the interagency agreements, analysis and interpretation of external audit reports, and problems relating to the effect of legislative developments.

During fiscal year 1951 the Comptroller intensified the audit activity and performed comprehensive audits of nearly all the major Bureau projects. After obtaining an inventory of the financial problems, an audit plan that will assist line offices at all organizational levels to strengthen specific accounting weaknesses and prevent continuance of recurrent errors was inaugurated. The plan consists of comprehensive audits, selective audits, special audits, and audits of water users' organizations.

Comprehensive audits will be facilitated by the establishment of resident auditors placed at the larger Bureau operating offices. Selective audits will concentrate audit attention and immediate corrective action on specific segments of the accounts where known or anticipated difficulties exist. Special audits will be performed in connection with negotiations with contracts, amendatory repayment contracts, cost allocation studies, and similar matters. Audits of water users' organizations will be performed for the purpose of protecting the contractual interest of the Government.

To effectuate the audit plan, the field audit organization is being strengthened by reorganization. This readjustment will permit a broader exercise of the Comptroller's field functions regarding financial policy per se and a more vigorous approach to enforcement by more direct and prompt action.

LEGISLATION

Several bills, affecting the Bureau of Reclamation program, had either been passed by the Congress or were still in the pending stage at the close of the fiscal year.

Of significant importance is Public Law 356, enacted by the Eighty-first Congress October 11, 1949, and pertaining to the American River Basin, Calif. It reauthorized Central Valley project, Calif., to include the American River Basin development consisting of Folsom Dam and Reservoir, a hydroelectric power plant and necessary hydroelectric afterbay plants and transmission lines, a storage dam on

Sly Park Creek, a diversion dam on Camp Creek and incidental works for the delivery of water to lands in El Dorado County, Calif.

The act requires that Folsom Dam and Reservoir be turned over to the Bureau of Reclamation after the Corps of Engineers completes construction to the extent where water from the reservoir is ready to be turned either into the power plant or the conduits. This act not only fulfills the President's recommendations regarding the American River Basin development but constitutes the first step in the direction envisaged by the President for administration of the Federal Government's water resource development and conservation program in the Central Valley Basin.

Rehabilitation of the Fort Sumner irrigation district in New Mexico was authorized by Public Law 192, enacted July 29, 1949; and construction, operation, and maintenance of Weber Basin project, Utah, by Public Law 273, enacted August 29, 1949, but construction appropriations requested for the latter project are expected to be delayed until certain steps have been accomplished.

Of vital interest to the Bureau was the enactment of Public Law 335 (H. R. 1694) on October 7, 1949, authorizing the repayment of rehabilitation and betterment costs to be deferred in those cases when current financing of such work is beyond the repayment ability of water users. That act was later amended by Public Law 541 on March 3, 1950, and the Bureau's rehabilitation may now go forward with the least possible delay.

As a follow-up to Public Law 56 enacted May 6, 1949, and which was the first omnibus amendatory repayment contract measure to be passed by the Congress, Public Law 419 was enacted October 27, 1949, approving contracts negotiated pursuant to section 7 of the Reclamation Project Act of 1939 with the Belle Fourche, Deaver, Westland, Stanfield, Vale, Oreg., and Prosser irrigation districts. Other important enactments by the Congress during the fiscal year included: Public Law 336, authorizing the Secretary of the Interior to complete construction of irrigation facilities on Buffalo Rapids project; Public Law 383, passed October 25, 1949, authorizing the withdrawal of public notices in Yuma project; Public Law 464 of March 21, 1950, granting the consent and approval of the Congress to compact entered into by the States of Idaho and Wyoming relating to the waters of Snake River; Public Law 491, enacted April 29, 1950, granting the consent of the Congress to the negotiation of a compact relating to the waters of the Canadian River by the States of Oklahoma, Texas, and New Mexico.

Still pending before the Congress are certain measures of importance to the Bureau of Reclamation program, the general welfare, and the areas immediately affected by them—measures that were pending at the close of fiscal year 1949. One of the most important of these is House bill 7351, successor to House bill 1770. Objectives of the two bills are the same, namely, first, to give statutory recognition to the fact that multipurpose Federal Reclamation projects frequently serve various purposes, the costs of which should not be borne by the water and power users; and, second, to afford a basis for an improved contract relationship between the Bureau of Reclamation and its irrigation users. However, House bill 7351, unlike House bill 1770, would not recognize the benefits of general salinity control, improvement of public transportation, protection of public health, promotion of the national defense, and the fulfillment of international obligations as purposes to which nonreimbursable costs should be allocated. Nonreimbursable allocations of cost related to sediment control and recreation would be recognized by House bill 7351 in a more limited manner than in House bill 1770.

Also of major importance in this category is a measure to authorize the Interior Department's portion of the joint Interior-Army comprehensive plan for the Columbia River Basin, including a Columbia Basin account. That measure in its original form by an amendment to the rivers and harbors flood control bill was tabled by the Congress.

Authorization of the North Fork Kings River power development as a part of the Central Valley project is another such measure introduced in the Congress over a year ago and which is still pending.

Also pending is House bill 2984, a bill to consolidate the Parker Dam power project and the Davis Dam project. Purpose of the bill is to permit economies and increase efficiency in the construction, operation, maintenance, and administration of those projects.

Other legislation pending before the Congress for over a year includes bills to authorize the Central Arizona project, and provide for the construction of Bridge Canyon Dam and Reservoir as one of its features (S. 75); to authorize the Canadian River project (H. R. 2733); and to authorize the construction of canals in the Sacramento River area as a part of the Central Valley project (H. R. 163).

At the beginning of the fiscal year 1951 it appeared that construction of the Eklutna power project in Alaska (H. R. 940) would be authorized in the near future.

Among the more important bills introduced in the Congress during fiscal year 1950 are Senate bill 2195, to authorize the Palisades Dam and North Side pumping division, Idaho; and Senate bill 1300, to conserve and increase the Nation's water resources by producing water suitable for consumptive use from sea and other saline waters.

LITIGATION

On June 5, 1950, the Supreme Court of the United States rendered its opinion in the action entitled "*United States* v. *Gerlach Live Stock Company*," and the related cases, Nos. 4-9, inclusive, October term 1949.

Those actions were initiated in the Court of Claims in 1944 and involved issues relating to the compensation of riparian land owners in the area of the San Joaquin River, Calif., for loss of water rights through the construction of Friant Dam by the Bureau of Reclamation. Although other issues were raised the most important appeared to be the contention that the Central Valley project was authorized by Congress under the commerce power as a measure for the control of navigation. Such an authorization, it was contended, makes applicable the rule that the Government does not have to compensate for the destruction of riparian interests over which at the point of conflict it has a superior navigation easement, the exercise of which occasions the damage.

The basis of that contention was the fact that in the Rivers and Harbors Acts of 1937 and 1940 (50 Stat. 844, 850 Stat. 1198, 1199) reauthorizing the project, Congress said that—

> The entire Central Valley project * * * is * * * declared to be for the purposes of improving navigation, regulating the flow of the San Joaquin River and the Sacramento River, controlling floods, providing for storage and for the delivery of the stored waters thereof * * * .

The 1937 act also provided that—

> The said dam and reservoirs shall be used, first, for river regulation, improvement of navigation, and flood control * * * .

The Court stated that the general declaration of purpose was intended to help meet any objection to its constitutional power to undertake the project. The Court then said:

> * * * The custom of invoking the navigation power in authorizing improvements appears to have had its origin when the power of the Central Government to make internal improvements was contested and in doubt. It was not until 1936 that this Court in *United States* v. *Butler* (297 U. S. 1), declared for the first time, and without dissent on this point, that, in conferring power upon Congress to tax "to pay the debts and provide for the common defense and general welfare of the United States," the Constitution delegates a power separate and distinct from those later enumerated, and one not restricted by them, and that Congress has a substantive power to tax and appropriate for the general welfare, limited only by the requirement that it shall be exercised for the common benefit as distinguished from some mere local purpose. If any doubt of this power

remained, it was laid to rest the following year in *Helvering* v. *Davis* (301 U. S. 619, 640). *Thus the power of Congress to promote the general welfare through large-scale projects for reclamation, irrigation, or other internal improvement, is now as clear and ample as its power to accomplish the same results indirectly through resort to strained interpretation of the power over navigation.* But in view of this background we think that reference to the navigation power was in justification of Federal action on the whole, not for effect on private rights at every location along each component project. [*Italics supplied.*]

After finding that the Central Valley project is a Reclamation project to be constructed under the provisions of the Reclamation Act of 1902 (32 Stat. 388, 390), so as not "to in any way interfere with the laws of any State or Territory relating to the control, appropriation, use, or distribution of water used in irrigation, or any vested right acquired thereunder * * *," the Court found that act required it to turn to the laws of the State of California to determine the rights and liabilities of landowner and appropriator.

The Supreme Court then upheld the finding of the Court of Claims, that a beneficial use was made of the natural floodwaters by the claimants to moisten their land and that their right to compensation has a sound basis in California law.

The United States District Court for the Southern District of California heard arguments on motions to dismiss applications for preliminary injunction in connection with the actions by *Everett G. Rank*, *Josephine Jasper*, *O. G. Cervelli and C. Cervelli*, *Hollister Land & Cattle Co.*, and the *Northern California Fisheries Association* and others who sought to enjoin the United States from diverting and transporting waters of the San Joaquin River to lands outside the watershed of that river or from entering into contracts for the sale of water of the San Joaquin River. The Court on April 12, 1950, denied the Government's motions to dimiss the complaints except that of the Northern California Fisheries Association and denied without prejudice the plaintiff's applications for a preliminary injunction.

Representatives of the Bureau of Reclamation and the Department of Justice continued to explore possible means of bringing to a conclusion the action entitled *Pioneer Irrigation District* v. *American Ditch Association et al.*, *United States of America, Intervenor.* The action was instituted many years ago in the Seventh Judicial District Court for the State of Idaho to determine the rights of the several parties to the waters of the Boise River.

The Court of Claims dismissed the petition in the case entitled *Columbia Basin Orchard et al.* v. *United States*, No. 48674, in which the petitioners sought damages for the alleged taking by the United States of its orchard. The Court's commissioner had previously filed a report in which he recommended an award of $70,000 in favor of the petitioners.

In connection with the cases entitled *Fine Sheep Co.* v. *United States; Ira R. Ure et al.* v. *United States; Ira R. Ure* v. *United States; and Scheff White et al.* v. *United States*, and consolidated cases, the United States District Court for the District of Oregon announced its decision. The cases included 191 actions for alleged damage to crops by reason of a failure to deliver water and two actions for alleged damage caused by flooding resulting from a break in the North canal of the Owyhee project. The court found in favor of the United States in the group of cases involving failure to deliver water and in favor of the plaintiffs in the cases involving damages by flooding. The amount of the damage has not been determined.

An action was instituted in the Court of Claims entitled *McCrary* v. *United States*, to recover damages for having been wrongfully separated by reduction in force from employment with the Bureau of Reclamation.

Alternative offers of settlement were made by the plaintiff in the action entitled *Washington Water Power Co.* v. *United States.* The offers are being considered by the Department of the Interior and the Department of Justice. The action was filed in the Court of Claims to recover for damages allegedly caused to the plaintiff's Little Falls power plant on the Spokane River, Wash., by reason of the filling of the Franklin D. Roosevelt Reservoir, Columbia Basin project.

Hearings were held on applications for an order for a preliminary determination and adjudication and the granting of a temporary restraining order providing for the distribution of the waters of the Carson River, Nev., in connection with the action entitled *United States* v. *Alpine Land & Reservoir Company.* In effect, the granting of the application would be a continuance of an order entered in 1949.

In connection with the action by the United States against the Northern Colorado Conservancy District, the city and county of Denver, and others, arguments on motions to dismiss for lack of jurisdiction were heard by the United States District Court for the District of Colorado. Briefs are now being prepared by the parties. The principal purposes of the action are to quiet title of the United States to the waters of the Blue River, which waters are required to operate the Green Mountain Reservoir of the Colorado-Big Thompson project and to obtain a judicial construction of the meaning and effect of certain portions of Senate Document 80, Seventy-fifth Congress.

Relative to the action entitled *Provo Bench Canal and Irrigation Company et al.* v. *United States*, which involves an appeal from a ruling of the State engineer affecting the water rights acquired by the United States for the Provo River project, Utah, the United States filed an action in the Supreme Court of Utah for a writ of prohibition against the District Court of the Fourth Judicial District in and for

Utah County, alleging that the United States has not consented to be sued and praying that the District Court be restrained from proceeding with the case. Briefs were filed and arguments were heard by the Supreme Court of Utah but no decision has been reached.

Approximately 165 proceedings to acquire lands and rights-of-way by condemnation were instituted during the fiscal year.

Assistance was given the Department of Justice in the conduct of the trials of the above and other cases and in the preparation of legal briefs, arguments, and proposed settlements.

General.—In response to requests by the President's Water Resources Policy Commission, the Office of the Chief Counsel prepared a statement on the Bureau's responsibilities for, and participation in: Development of water resources; utilization of water resources; conservation of water resources; land uses related to development, utilization, and conservation of water resources; and other public purposes to the extent that they are directly concerned with water resources.

In connection with such responsibilities and participation, separate reports were prepared as follows:

A sectional analysis of each statute and executive or administrative order; a legislative history of each statute; conflicts and duplications between the responsibility and participation by the Bureau and those of any other Federal or State agency; State statutes and judicial decisions which have aided or impeded fulfillment by the Bureau of such responsibilities and participation; an analysis of judicial decisions in determining or interpreting the scope of statutory or other provisions which imposed such responsibilities or authorized such participation; the Federal water-resources policy sought to be achieved through fulfillment of the Bureau's work; and special legal problems encountered.

The Office of the Chief Counsel participated in all other phases of the Reclamation program which required legal assistance including such matters as repayment, power sales, service, construction, supply, and other contracts and amendments thereto, interbureau agreements, lands and water right acquisitions, and planning reports. Under a delegation of authority, regional counsel of the Bureau administratively determined claims up to $1,000, filed under the Tort Claims Act and the claims item in the annual appropriation act.

MANAGEMENT PLANNING

Emphasis in the Bureau of Reclamation's organization planning, both in the Washington office and the regions, continued to be placed upon more effective use of staff branches and district offices, and upon the solution of specific management problems.

Noted progress has been made toward developing greater awareness of management factors that increase the efficiency and effectiveness of Bureau administration and facilitate program accomplishment. Although the President's management improvement program (officially promulgated July 29, 1949) did not necessitate any major changes in the Bureau's program for improving management, it served to increase the tempo with which management planning went ahead.

Numerous specific management problems were identified and resolved by the management staffs during the year, in cooperation with the Bureau's branch offices. Specific field studies of an administrative review character and coordinated programs for further work on specific operating, procedure, and policy problems were developed.

Concentrated effort progressed toward completion of the Reclamation Manual, encompassing all policy and procedural instructions, methods, and standards for carrying out the Bureau program; and on the refinement of material already published. At the close of the fiscal year, the Branch of Design and Construction was nearing completion of its work in condensing the extensive engineering material for which it has primary responsibility, and in eliminating technical data from the manual through a planned system of specialist handbooks.

The Bureau's program for control and improvement of forms and reports went into full gear during the fiscal year. In the initial review of forms, the total number in active use was reduced a spectacular 50 percent. During the next fiscal year additional tangible economies are anticipated through continuing appraisal of Bureau reporting needs and procedural requirements.

PERSONNEL

Although still restricted by congressional limitations on the number of employees who could be engaged on personnel work, the Bureau personnel staffs concentrated on planning and developing a forward-looking personnel management program. Emphasis was placed on forecasting staffing requirements and programing placement of available employees according to workload, construction engineer development, rotation of beginning engineers, recruitment and college relations, letter-writing improvement, and personnel procedures inspection.

The employee utilization program increased steadily with launching of the construction engineer development program and initiation of a pilot plan for junior accountant trainees. Evaluation of the programs instigated last year, namely, the administrative trainee, rotation of GS–5 and GS–7 engineers, and the scheduling of staffing requirements, has resulted in their extension to regions, districts, and projects where needs have existed.

To provide an adequate staff for Bureau operations, considerable recruitment activity was undertaken. The Central Board of United States Civil Service Examiners for the Bureau processed 9,712 applications, and 2,127 persons were appointed. Among these were 770 graduate engineers recruited on a Nation-wide basis. These beginning engineers came from 109 different colleges located in 47 of the 48 States. In addition, 232 undergraduate engineers, under the student engineer plan now in its third year of operation, received probationary appointments. They work, principally, during the summer months and will provide a source of carefully selected new engineers upon graduation. A small number of student engineers were employed on the cooperative college plan and worked alternating periods the year round.

The apprenticeship program is in operation at the Boulder Canyon project and at Parker Dam in region 3. Other regions are considering its early inception to provide skilled workers in the trades and crafts.

The collective-bargaining type of labor agreement is in operation on one major Reclamation project. Equitable hourly rates, based upon the principal of paying employees in accordance with local prevailing rates, were kept current by the Bureau's wage boards.

Progressive improvement in labor relations was brought about by effective negotiations through the Bureau labor relations officer for the 22,000 contractors' employees, with a creditable low percentage of man-days lost because of work stoppages.

The Bureau's safety program was further intensified. A 28-percent reduction in the number of accidents under the rate experienced in 1949 continued a desirable downward trend. Safety inspections were performed in all Bureau operations and a program of safety education was continued. The Federal employee health program was in its field try-out stage at the Denver Federal Center and the Bureau was the principal participant.

Through incentive programs, such as rewards for superior accomplishment and suggestions, employees were awarded approximately $7,000. Distinguished service awards were given to 9 employees for outstanding service; meritorious service awards to 13 employees for exceptionally meritorious service; and 30 employees were granted commendable service awards upon retirement.

With passage of the Classification Act of 1949, impetus was given to the classification program. New policies and procedures were developed, and contacts with field installations were expanded to acquaint management with the many ramifications of the act. The inspections of decentralized field operations were intensified. Reorganizations of various field installations required the active attention of Classification to place positions on a current and accurate basis during the fiscal year.

Forty inspections were made covering all offices with a GS–7 appointing authority and above. The inspections were broadened to include questions on classification, employee relations, hours of duty, and employment.

On June 30, 1950, the Bureau had on the rolls 18,962 full-time employees, 14,846 of whom were under the Classification Act and 4,116 under the wage boards. Of this number, 10,287 were entitled to veterans' preference; 2,387 were women.

During the year several top-ranking Bureau employees were loaned or given assignments to foreign governments for consulting purposes.

Import changes in key personnel included the appointment of Goodrich W. Lineweaver as Assistant Commissioner on April 28, 1950. He was succeeded by Eugene D. Eaton as Acting Director of the Branch of Operation and Maintenance. William F. Kubach retired as Comptroller of the Bureau on April 30, 1950, and W. Darlington Denit was appointed as his successor on May 1, 1950.

SUPPLY

Airplane Operations

The Bureau of Reclamation maintained and operated a fleet of 6 aircraft, including 1 twin-engine, 10-passenger Lockheed Lodestar; 2 twin-engine, 5-passenger Beechcrafts; and 3 single-engine, 3-passenger Fairchilds.

The Lodestar, assigned to the Washington office, was used to transport Departmental and Bureau officials and Members of Congress to observe construction of Bureau dams, power plants, canals, transmission lines, and other structures, many of which are located in areas off the regular commercial transportation routes; thus, visits were made in a minimum of time and usually at rates equal to or less than the cost of commercial transportation.

The two Beechcrafts, assigned to regions 3 and 6, respectively, were used to transport regional staff personnel to areas not generally served by commercial facilities, for inspection of proposed transmission line rights-of-way and surveillance of flood-water conditions. The three Fairchilds—overhauled surplus aircraft of prewar vintage acquired from Civil Aeronautics Administration—have proven extremely valuable to the district offices where they are assigned. These aircraft can be landed in relatively small areas and have provided means of transporting district headquarters personnel to construction sites for inspections in much shorter time than could surface transportation.

Two additional single-engine aircraft, authorized by the 1950 Appropriations Act, were ordered. The first new aircraft to be acquired by the Bureau, they will be of modern design with higher cruising speeds, generally safer operations, and will carry pilot and four passengers.

Procurement Activities

Detailed procedures covering the scheduling of procurement of all materials to be furnished by the Bureau for its construction program were developed during the year. Through this procurement scheduling program all parties concerned will be currently informed of all items to be procured by the Bureau in connection with the construction of any project, all Bureau organization units involved in any phase of the project will be currently and accurately informed of the status of procurement activity, and all items of equipment and supplies to be furnished by the Government will be delivered to the project when needed. Advantages of this program have been thoroughly proven through complete field tests made at one of the Bureau's large construction projects. Instructions for carrying out this program have been included in the Bureau's manual instructions and will be used by all Bureau projects in the future.

A clear-cut policy concerning materials and equipment to be furnished by contractors as part of their agreement with the Bureau to build the several types of structures required in the Bureau's construction program was established after views of field procurement and administrative officers and project engineers were obtained. This policy will be used as a guide in preparing specifications for all future construction work for which the Bureau secures bids. It provides generally that the Government will furnish, for installation under general construction contracts, specially designed materials and equipment such as fabricated steel, machinery, steel pipe and penstocks, large electrical and mechanical apparatus and equipment; that contractors will furnish all standard and stock construction materials, specially fabricated metal work and prefabricated items for which requirements, details, and quantities involved can be included in the general construction specifications without appreciably delaying their issuance.

More expeditious procurement of heavy machinery for the Bureau's construction projects and reduction of paper work involved have resulted from rescission of the Federal Supply Service's requirement that such equipment be purchased only through that organization. The requirement was rescinded primarily because of objections raised by the Bureau. The Bureau then centralized purchase of such machinery in its Denver procurement office where acceptable specifications could be developed to cover the several types of machinery required for Bureau construction. When standard specifications have been developed, it is planned to redelegate authority to the field to procure this type of equipment.

Because of difficulty in procuring heavy-duty trucks and items of specialized automotive equipment, the Bureau has requested Federal Supply Service to rescind the part of its Circular B–20 requiring that 1½-ton and larger trucks, and all types of specialized, motorized equipment be procured through that agency. The Director, Federal Supply Service, is now considering this recommendation.

In order to implement the Bureau's policy of better utilization of automotive equipment, a directive, issued early in the fiscal year, prohibited the procurement of certain types of station wagons and directed that only such vehicles as have been proved to provide the greatest possible utilization would be acquired.

Extensive efforts were made during the year to divert as much of the Bureau's business as possible to small business concerns. A reporting procedure was instituted whereby data are collected on all Bureau procurement activities and the amount allocated to small business. These reports have not been in effect sufficiently long to determine the value of data obtained as compared to the cost of collecting it.

Substantial savings to the Bureau have resulted from administrative examination of transportation vouchers, a program inaugurated during the fiscal year. Previously, General Accounting Office instructions had been interpreted as prohibiting such examination and vouchers were submitted without administrative audit. Adoption of the money-saving policy resulted from complete review of the matter and further discussions with General Accounting Office representatives.

After conferences with Bureau representatives, several large railroads have indicated their willingness to review estimates of quantities and types of materials and equipment that would need to be transported for the building of Reclamation structures and to furnish the Bureau with tentative special freight rates that might be used in calculating ultimate costs of structures involved; thus, savings resulting from negotiated rates could be taken into account in determining feasibility of proposed projects. Also, elimination of many of the controversies that have developed with carriers in the past regarding rates for hauling materials and equipment to Bureau projects could result from such a procedure.

Property Management Activities

Inventories of all the Bureau's accountable property were completed on more than 90 percent of all Bureau projects during the year—the first year since the Office of Supply was organized that inventories have been so nearly complete. Procedures, devised for easy integration with the Bureau's accounting system, were developed to reconcile these inventories with fiscal accounts. Considerable progress has been made in developing a consciousness of the need for stewardship of Government property at all levels of the Bureau's organization. Procedures concerning the receipt, storage, issuance, warehousing, and disposal of Bureau property have been carefully scrutinized for maximum simplification consistent with a high degree of stewardship responsibility.

A vigorous program to increase the utilization of Bureau-owned vehicles, including a system of preventive maintenance and a study to insure that only those vehicles actually needed are maintained and used was continued. With the goal of a reduced fleet of vehicles so maintained and allocated that no aspect of the Bureau's work will suffer from lack of adequate transportation, automotive costs were reduced by $350,000 and automotive vehicles by 448.

How best to protect the interest of Government in the control of small tools and minor equipment without incurring a volume of record-keeping disproportionate to the value of the items controlled, was still under consideration. Work continued toward a policy to free financial records of the burden of keeping track of such items while preserving accountability.

Public Law 152, creating the General Services Administration, brought many problems concerning property disposal, including one in connection with disposal of surplus structures on land that is not to be disposed of and which were acquired with reimbursable funds. In most instances these involve structures on reservoirs, rights-of-way, etc., which cannot be disposed of for use in their present locations. Conferences with General Services Administration representatives resulted in authority to dispose of such surplus structures without reference to the detailed procedures established by GSA.

Office Services Activities

An extensive program aimed at ultimate disposal of many Bureau records and reduction of the quantity of files that now must be preserved and handled was undertaken during the year. Schedules for disposal of many types of Bureau records, including those of temporary value, are being worked out in cooperation with National Archives.

Importance of office management work and the need for highly qualified specialists in this field was emphasized and considerable progress made throughout the Bureau in this respect.

REGIONAL REPORTS

Region 1

General investigations.—A major accomplishment of region 1 in its planning and investigation program during fiscal year 1950 was the completion of a report on the Rogue River Basin project, Oregon, presenting a general plan for the irrigation of about 114,000 acres and the installation in three plants of 61,000 kilowatts of hydroelectric power. The acreage-irrigation plan includes 74,000 acres of new land and 40,000 acres for which supplemental water will be provided. Total cost of the project is estimated at $76,500,000. The region also participated in preparation of a report on the basin for the Pacific Northwest Field Committee.

All told, the region worked on 5 reconnaissance investigations, 3 basin studies, 28 project investigations, 14 studies of existing projects, 7 investigations classed as general engineering research, and 1 advanced planning study.

Completed reports, in addition to Rogue River Basin, included those on Kalispell project in western Montana and the eastern division of the greater Wenatchee project in Washington. Refinement of the comprehensive plan for development of Columbia River Basin was advanced; and substantial progress made on development of a river operation plan by subcommittees of the Columbia Basin Inter-Agency Committee, with strong participation by Reclamation Bureau's regional representatives. A special report, entitled "Data on Projects in the Coordinated, Comprehensive Plan for Development of the Columbia River Basin," was prepared; and a special report on the domestic water system for the Deschutes project, Oregon. Two reconnaissance reports were completed and substantial progress made on the region's portion of the united western investigation; an advanced planning study was made for the authorized Kennewick division of Yakima project, Washington.

Construction.—Completion of six irrigation projects involving approximately 100,000 acres of new land and expansion of Reclamation's hydroelectric capacity at Grand Coulee Dam by nearly a third of a million kilowatts highlighted construction work in the region. Big event of the year was formal dedication of Grand Coulee Dam and its 151-mile reservoir, Franklin D. Roosevelt Lake, by President Truman on May 11, 1950.

Irrigation projects completed include the 50,000-acre North unit of Deschutes project in central Oregon; the 27,000-acre Pump unit of Roza division, Yakima project, in eastern Washington; the 25,000-acre Black Canyon unit of Boise project in southern Idaho; the 900-acre Big Flat unit of Missoula Valley project in western Montana; the 1,300-acre Burbank unit of Columbia Basin project in eastern Washington; and the 1,000-acre Hayden Lake unit of Rathdrum Prairie project in northern Idaho.

Columbia Basin project, in the biggest year of construction activity in its 17-year history, was 48 percent completed on July 1, 1950; contractor earnings totaled $53,500,000, almost 70 percent higher than fiscal year 1949, a record year in itself.

Accrued Columbia Basin project resources now include completed Grand Coulee Dam; 13 hydroelectric generators, largest in the world; and more than $100,000,000 invested toward the ultimate irrigation of 1,029,000 acres in the basin. Some $21,500,000 in new construction contracts were let during the year; about two-thirds of these for the irrigation phases of the project. The first water from Grand Coulee is to be available to 87,000 acres in 1952; it is toward this event that all major phases of construction moved.

Major irrigation works completed include O'Sullivan Dam, an earthwork structure with a volume almost equal to Grand Coulee; South Dam, which seals the lower end of Grand Coulee's equalizing reservoir; the 10,000-foot Bacon Tunnel; the Bacon siphon; and work on major canals, including the first sections of both the East Low and West Canals. Status of other work is as follows: Grand Coulee pumping plant, 72 percent complete; the feeder canal, able to carry any but the largest rivers in the Nation, within 4 months of completion; North Dam, which seals the upper end of Grand Coulee reservoir, 70 percent complete; second and third sections of East and Low Canals, under way; Burbank pump unit No. 1, substantially complete; Soap Lake siphon, largest in the world, 80 percent complete; power installation, 88 percent complete, with 23.1 percent of the work done during the fiscal year. Other work in progress: A $1,691,000 contract to place armor rock on the river bank below the dam; a $1,488,000 contract to develop a permanent industrial area for the dam; and repair of the spillway bucket with the use of a floating caisson.

Hungry Horse project in northeastern Montana, largest concrete dam now under construction in the world, was 32 percent complete on the basis of the total estimated cost of $108,800,000, climaxing 15 months of intensive construction activity since the first concrete was placed September 7, 1949. By the end of the fiscal year, 300,000 of the nearly 3,000,000 cubic yards of concrete required to complete the dam and power plant were in place; the dam towered 139 feet above bedrock, was rising 1 foot a day toward its ultimate height of 564 feet.

Simultaneously, the tremendous job of clearing Hungry Horse project's 34-mile long reservoir area was under way; 55 to 60 percent of an estimated 80,000,000 board-feet of merchantable timber had been removed, and approximately 40 percent of the 23,500 acres that will be flooded by the 3,500,000 acre-foot reservoir had been completely cleared. Clearance was well ahead of schedule as the result of a new "highball" method pioneered by two major clearing contractors during the spring of 1950. The method, utilizing huge 8-foot diameter 4½-ton steel balls, fastened to heavy wire cable up to 2,000 feet in length, and pulled by power tractors, has proven so successful that it is expected to revolutionize the clearing industry. It is expected to result in savings of millions of dollars on future clearing jobs.

On Boise project, the lateral distribution system to serve the 25,000-acre Pumping unit of Fayette division was completed; work continued at Cascade Dam, source of water supply for the area. Construction continued at Anderson Ranch Dam on spillway, outlet works, and power plant, the dam providing 314,000 acre-feet of storage and full storage of 493,000 acre-feet set for 1950, while initial generation of power from one of the two 13,500-kilowatt units being installed is scheduled for September 15, 1950.

Work completions on Deschutes poject included Wickiup Reservoir; rehabilitation of Ochoco Dam for the Ochoco Dam irrigation district; reconstruction of Northwest unit pipeline for Grants Pass irrigation district; reconstruction of Arnold flume for the Arnold irrigation district. Lewiston Orchards project completion, scheduled for the first half of fiscal year 1951, has been delayed due to exhaustion of funds, a water-treatment plant and domestic water reservoir remaining unfinished; the irrigation and domestic water pipe distribution systems were completed during the year.

Start of major construction on Palisades Dam awaits reauthorization of the project by the Congress; however, construction of the Palisades-Goshen transmission line progressed on schedule for completion early in fiscal year 1951; 33 percent of the relocation of 2.5 miles of highway at the dam site was completed. The lateral system for 17 pumping areas embracing 27,000 acres of the 72,000-acre Roza division was completed on the Yakima project. Under the rehabilitation and betterment program, rehabilitation of pump-discharge and siphon lines for the Prosser irrigation district was completed and Tieton Dam and spillway rehabilitation was substantially completed.

Rehabilitation of Rock Creek diversion dam and flume 18 of the main canal of Bitterroot project and Little Valley siphon of Vale project was finished.

Determining feasibility of irrigating approximately 64,000 acres by pumping from underground water supplies was continued on the North Side pumping division of Minidoka project; pumps were installed and lateral systems completed for three wells previously drilled; drilling of four additional irrigation wells was completed and contract awarded for drilling four observation wells.

Operation and maintenance.—The 17 operating projects in the region, embracing 1,948,014 acres receiving a full or supplemental supply of water from Reclamation Bureau works, produced crops valued at $172,922,032 in 1949. Average gross return per cropped acre was $88.77, as compared with $106.03 in 1948, and the highest on record—$120.18—in 1947.

Northwest projects again made available public land to meet the great demand for farming opportunities by World War II veterans and other qualified persons. Fifty homestead units, embracing 4,489 acres of irrigable land on Payette division of Boise project, were awarded on March 25, 1950; total of 1,427 ex-servicemen qualified for the drawing at Caldwell, Idaho. Eleven public-land homesteads, comprising 723 acres, were opened to entry on Roza division of Yakima project on March 21, 1950, the drawing to be held July 21, 1950. The availability of farm units, comprising 678 acres on Burbank pumping unit of Columbia Basin project was announced May 3, 1950, the drawing to be held in fiscal year 1951, as will a sale of 56 part-time farm units in the area.

Federal irrigation service was extended to 6,000 acres on Payette division of Boise project, 1,300 acres under Burbank pumping unit, and 27,000 acres under pump on Roza division.

A fourth "development" farm on Columbia Basin project was established south of Quincy, another unit of the cooperative research program in which the Department of Agriculture's Bureau of Plant Industry and Soil Conservation Service and the Washington State Experiment Station are cooperating with the Bureau of Reclamation.

Work leading toward execution of amendatory, supplemental, or interim repayment contracts was carried forward for 20 irrigation districts. Repayment contracts were executed for Stanfield and Westland irrigation districts of Umatilla project, and for Prosser and Sunnyside districts of Yakima project. An amendatory repayment contract was being executed at the close of the year by Frenchtown irrigation district.

Negotiations were under way with eight irrigation districts of Owyhee project, Black Canyon irrigation district of Boise project, and Roza division of Yakima project. An economic report and repayment plan were contemplated for each of the following: North unit irrigation district, Deschutes project; Hermiston and West extension districts, Umatilla project, Wilder irrigation district, Boise project. Preliminary work was started on Kennewick division of Yakima project, including land appraisal and classification and preliminary construction surveys, and plans were initiated for undertaking a repayment study.

Cooperative working agreements were made with the University of Idaho, Oregon State College, Washington State College, and the States of Idaho and Wyoming for carrying on activities of mutual interest in the fields of project development, construction repayment, and capital and credit requirements on irrigated farms. Progress was also made on studies relating to weed control, operation and maintenance costs, excess lands, income-tax payments, and car-lot rail shipments.

Power production.—The five Bureau hydroelectric plants in the region increased the power output to a new high of 10,700,925,138 kilowatt-hours of energy during the year, to meet increasing demands for power in the Pacific Northwest. The output of Grand Coulee Dam's huge plant was wholly responsible for the increase. The gross revenue totaled $8,020,281.75.

Grand Coulee, the world's largest power plant with an installed name-plate capacity of 1,424,000 kilowatts, carried a peak load of 1,590,000 kilowatts in May and produced 10,505,939,200 kilowatt-hours during the year. Gross revenues totaled $7,342,081.19. A daily record of 35,928,000 kilowatt-hours was established on February 1, 1950, with a monthly record of 1,022,062,000 kilowatt-hours set in January. Almost half of dam's record annual output went to aluminum industries. Three new 108,000-kilowatt units were put into operation during the year, bringing the installation to 13.

The 13,400-kilowatt Minidoka power plant produced 102,932,650 kilowatt-hours to earn gross revenues of $432,739.77. Boise project, with the 8,000-kilowatt Black Canyon and 1,500-kilowatt Boise River plants, produced 67,036,888 kilowatt-hours to earn $94,813.79 in gross revenues. The 2,400-kilowatt Prosser plant on Yakima project produced 25,016,400 kilowatt-hours, earning $60,647 in gross revenues.

REGION 2

General investigations.—During the year the Central Valley Basin report was transmitted to Congress and printed as Senate Document 113, Eighty-first Congress, first session. The report on the North Fork Kings River development was transmitted to Congress and printed as House Document 537, Eighty-first Congress, second session.

Significant developments in connection with the Central Valley Basin plan, California, included the preparation of a status report on the San Luis division, a preliminary report on the Lower Feather River development, and the submittal of an interim report on the Sacramento River canals to the Senate Committee on Interior and Insular Affairs in connection with H. R. 163, an act to authorize Sacramento Valley irrigation canals, Central Valley project, California. Substantial progress was achieved upon San Luis Obispo, Sacramento River canals, Trinity River division, Feather River, San Luis, Klamath Basin, Pajaro River investigations, and advanced planning work on the Solano project.

Construction.—The first major expansion in the scope of Central Valley project since its original authorization occurred when Congress directed the inclusion into the project of Folsom Dam upon its completion by the Corps of Engineers and authorized the Folsom power plant and pertinent facilities and the Sly Park irrigation unit for construction and operation as a part of the Central Valley project (Public Law 356, 81st Cong., 1st sess.) Following the congressional action, the principle of integrated operation was endorsed in the President's letter upon transmitting the Central Valley Basin plan to Congress. This endorsement, known as the "Folsom Formula," states that multipurpose dams are the responsibility of the Bureau of Reclamation and that works exclusively for flood control are the responsibility of the Corps of Engineers.

Central Valley project features essentially complete and in operation in fiscal year 1950 were Shasta Dam and Reservoir, Friant Dam and Reservoir, Madera and Contra Costa canals, Shasta and Keswick power plants. Initial deliveries of water from the first 73 miles of Friant-Kern canal were made. Construction proceeded at an accelerated rate on the uncompleted features of the Central Valley project and got under way on the Cachuma project. Enlargement and modernization of the Klamath project proceeded on schedule.

During the fiscal year installation of the three 25,000 kilovolt-ampere generators at Keswick power plant was completed, the units placed in service, and a contract for the completion of Keswick Dam, power plant and switchyard was 90 percent complete at the end of the year.

The first major contract for construction of Tracy pumping plant building was completed on December 30, 1949. The contract for completion of Tracy pumping plant, including installation of six 767-cubic-feet-per-second pumping units and six 22,500-horsepower motors and related equipment, was 52 percent complete on June 30, 1950, and is scheduled for completion in July 1951. Construction of the 15-foot-diameter concrete and steel discharge pipelines between the pumping plant and Delta-Mendota canal was practically complete on June 30.

Specifications were issued and contracts awarded for completion during the next fiscal year of the 231-mile East Side single-circuit and 213-mile West Side double-circuit 230-kilovolt transmission lines from Shasta switchyard to Tracy. A contract for the construction of Tracy switchyard was 52 percent complete on June 30, 1950, and is to be completed by June 1951.

Thirty-nine miles of the 117-mile Delta-Mendota canal and the Intake canal to the Tracy pumping plant were completed by June 30, 1950. The remainder of the canal, including wasteways, is under contract with completion of all parts required for initial operation scheduled for July 1951. On June 30, 1950, 117 miles of the 153-mile Friant-Kern canal were complete and the remaining 36 miles are under contract. The canal is scheduled for completion to Kern River in July 1952.

Work was started under two contracts for the construction of distribution system for the Southern San Joaquin municipal utility district. Specifications for the next contract are being prepared and will be issued early in fiscal year 1951; completion of the first unit is scheduled for January 1951; and of all units, for October 1952. Two contracts are under way for construction of the distribution systems for the Lindmore irrigation district. Preliminary plans were started for the Ivanhoe, Lindsay-Strathmore, Exeter, Stone Corral, and Sausalito irrigation district distribution systems.

On the Cachuma project near Santa Barbara, construction work for the 6½-mile Tecolote tunnel and the 10-mile Goleta section of the South Coast conduit was started. Specifications were issued in June 1950 for Cachuma Dam.

Power production.—Water supplies for production of power, while below normal for the region as a whole, were sufficient to prevent a reoccurrence of the power shortage of the previous year.

Energy sales and power revenues totaling 1,730,966,570 kilowatt-hours and $9,340,726.66 respectively, for the Central Valley project, exceeded those of any previous year. Fiscal year 1950 revenue exceeded that of fiscal year 1949, the previous high year, by almost 40 percent. All energy that it was possible to deliver was sold, and wastage of water from which power could have been generated was nonexistent after completion of Keswick. Of the total energy sales, 99.3 percent was sold to the Pacific Gas & Electric Co. under terms of the day-to-day agreement in effect since January 1, 1949. Substantial progress was made on negotiations toward a contract to replace the day-to-day agreement and to include provisions by which the company would transmit project power over its system to project customers.

Assistance was given to the Department of National Defense in planning facilities for procurement of power service from the Central Valley project, particularly for Naval Shipyard, Mare Island, and Camp Stoneman.

Operation and maintenance.—A Central Valley project operations office with a superintendent in charge was established to direct the operation and maintenance of the physical works. Water sales contracts were negotiated under Reclamation law to the extent that most of the water available under the initial features of Central Valley project has been sold. On July 9, 1949, the first section of the Friant-Kern canal was placed in operation. Project water deliveries were made for the first time to eight irrigation districts in the service area under temporary contracts. Two irrigation districts along the Madera canal also received project water under temporary contracts. Approximately 20 interim contracts for water service along the San Joaquin River were handled during the year.

Contract negotiations were completed and a contract executed with the Ivanhoe irrigation district. Contract negotiations were carried on and proposed contracts with the Madera, Tulare, Exeter, Stone Corral, Terra Bella, Lindsay-Strathmore, and Sausalito irrigation districts, and the Chowchilla water district were approved as to form by the Secretary.

On September 23, 1949, the water service contract between the United States and the Santa Barbara County Water Agency was executed.

A repayment plan for the Tule Lake division of the Klamath project was approved by the Commissioner. Initial meetings with the Tule Lake water users indicated a willingness on their part to organize an irrigation district.

Revenues from the sale of water during the fiscal year totaled $874,000, and through fiscal year 1950 amounted to approximately $2,424,000.

REGION 3

General investigations.—Considerable progress was made on studies of potential projects in the lower Colorado River Basin. At Bridge Canyon an access road to the Bridge Canyon Dam site and a route for a line to supply power for construction have been located and townsites for construction and operation forces have been explored. Bridge Canyon Dam is a feature of the potential Central Arizona project.

As a service to region 4, field work for the potential Glen Canyon Dam was carried to a point where preliminary design studies can be made during fiscal year 1951. At Marble Canyon, Bureau forces have constructed roads and trails and an access cableway so that geologic examination and drilling of dam sites can be carried on. Various other studies have been made in connection with the potential dams on the Colorado River and its tributaries.

Studies of a second barrel to the San Diego aqueduct, being investigated by the Bureau under a contract with the San Diego County Water Authority, were expedited and are scheduled to be completed in fiscal year 1951.

Other investigations work was performed in connection with the Dixie, Moapa Valley, and Santa Margarita projects. Investigation of the Victor project was reactivated.

Construction.—The Davis Dam project, under construction since March 1946, neared completion. The first of the power plant's five 45,000-kilowatt generators is scheduled to go on the line in January 1951. The Davis-Mesa-Coolidge, Davis-Hoover, and Davis-Parker 230-kilovolt lines and the Parker-Gila 161-kilovolt line will be completed and in service about the same time. All of the Davis power plant units will be in operation by the end of fiscal year 1951. The Davis power plant will add approximately a billion kilowatt-hours to the present annual output of Colorado River dams.

All of the 18½ mile Wellton-Mohawk canal on the Gila project was brought under construction and completion is expected by the end of fiscal year 1951. A contract for construction of 30 miles of the Mohawk canal, a branch of the Wellton-Mohawk, was awarded and work on an additional 10 miles of the canal will be started in fiscal year 1951. The first water from the Colorado River is expected to flow through the canal sytem in the spring of 1952. Upon completion, the Wellton-Mohawk system will serve 75,000 acres.

The first six units of the Coachella Valley underground distribution system were completed sufficiently to turn over to the water users for operation. Construction on unit 7 and initiation of work on units 8 and 9 were delayed pending availability of funds. At the close of the year nearly 25,000 acres in the Coachella Valley were being irrigated from wells and the lateral system. The system is designed to irrigate about 78,500 acres in the valley when completed.

Preparations were made for the installation of units A–3, A–4, and A–9 in the Arizona wing of the Hoover power plant. Unit A–9, 50,000 kilowatts, and unit A–4, 82,500 kilowatts, are scheduled to go on the line in November 1951. Unit A–3, also 82,500 kilowatts, will follow in January 1952. The three units will complete the installation in the power plant's Arizona wing, raising the plant's installation to 1,249,800 kilowatts. The installation of an 82,500-kilowatt unit in the Nevada wing, yet to be ordered and contracted for, will complete the power plant's installation of fifteen 82,500-kilowatt units and two smaller units, bringing the plant's capacity to 1,332,300 kilowatts.

Power production.—The Hoover and Parker power plants on the Colorado River generated about 6,750,000,000 kilowatt-hours of energy, or about 42 per cent of the region's power requirements and about a third of the total generation of all Bureau power plants.

Operation and maintenance.—Farms in southern California and Arizona, in the lower Colorado River Basin, irrigated by Reclamation facilities, produced an income last year of about $152,000,000, or approximately 30 percent of the total crop values from farms on all Reclamation projects.

The Colorado River dredge sank near Needles on November 4, 1949 and was raised, rehabilitated, and returned to service by the following June. Dredging of the 12-mile channel through the swamp between Needles and Topock, Calif., is progressing under a 24-hour day, 7 days a week schedule. During the past few years, Needles has been threatened by a raised water table caused by silting up of the river at that point. The dredging will restore the river to a definite channel with a resulting lowering of the water table.

Rehabilitation work was initiated on the Salt River project's irrigation system. The Bureau of Reclamation is advancing funds for the work, which is being performed by the Salt River Valley Water User's Association.

REGION 4

General investigations.—The Weber Basin project was authorized by Congress in August 1949 and plans were immediately put into action to expedite preparation of the Definite Plan report. Cooperative arrangements with the Department of Agriculture and the Utah State Agricultural College on joint studies and investigations are intended to avoid duplication of work and expedite clearance of the final report. The Definite Plan report for the Eden project was approved on June 14, 1950, as a basis for issuance of bids for construction of Big Sandy Dam. A Definite Plan report was prepared for the Paonia project outlining some desirable revisions in the approved project plan.

Reports are nearing completion on 11 projects in the upper Colorado River Basin which were recommended by the upper basin States to participate in revenues of the Colorado River storage project. The 11 projects are: Central Utah, Emery County, Fla., Gooseberry, Hammond, La Plata, Lyman, Pine River extension, Seedskadee, Silt, and Smith Fork. Preparation of the report on the Colorado River storage project is nearing completion following the approval in June 1950 by the secretary of Echo Park as a unit of the project. The Collbran project report was submitted to the President on May 9, 1950, as a proposed project independent of the Colorado River storage report.

The region entered the field of small project investigations in instituting and completing during the fiscal year a preliminary investigation of the West Gem project, Idaho.

Construction.—Approximately $7,173,170 of a $7,483,500 construction program was accomplished. The Salt Lake aqueduct which stretches some 42 miles in length to transfer water from Deer Creek Reservoir to the vicinity of Salt Lake City moved nearer completion by finishing 7.5 miles in Salt Lake County and part of the remaining 5.5 miles in Provo Canyon. The Duchesne tunnel, a companion feature, to divert water from the Duchesne drainage into the upper Provo River was rehabilitated for 2.3 miles previously constructed, and excavation was begun on the remaining 3.7 miles. On June 29, 1950, 3 days after the bid opening, a contract was awarded for the construction of the Big Sandy Dam and dike. This earth-fill dam, 2,300 feet long and 80 feet high, is the major feature under the Eden project, Wyoming.

In addition to the above features programed for construction and completion in the near future, five sets of specifications were issued for canals and structures by the regional office. These included the construction of a lateral system and two equalizing reservoirs to serve the project lands of the South Ogden distribution system, two siphons and a wasteway on the Fire Mountain canal of the Paonia project, and three canal construction jobs on the Provo River project. Possibly no other construction in region 4 is more noteworthy than that of reconstructing a section of tunnel No. 3 on the Highline canal of the Grand Valley project, Colorado. This emergency work of constructing 2,200 feet of bypass tunnel in record time brought water to thirsty lands ahead of schedule and saved millions of dollars in crop value for 1950. This accomplishment was made possible by innovations in contract procedure and by cooperation among various offices of the Bureau and excellent management by the contractor.

Operation and maintenance.—On March 3, 1950, an amendatory contract was executed with the Grand Valley Water Users' Association under Public Law 335, for rehabilitation and betterment of project works on the Garfield Gravity Division. Among other works, this contract covered the emergency construction of 2,200 feet of bypass tunnel on the Grand Valley tunnel No. 3 and was a significant factor in early initiation and completion of construction. On September 6, 1949, an amendatory contract was executed with the Pershing County Water Conservation (Humboldt project) eliminating incremental value povisions. A similar contract with the Washoe County water conservation district (Truckee River storage poject) was executed on August 12, 1949. The Ogden River Water Users' Association (Ogden River project) on April 23, 1950, and the South Cache Water Users' Association (Hyrum project) on April 24, 1950, executed amendatory repayment contracts which have been submitted to the Secretary and the Congress for action.

On the Mancos project, Colorado, the notice of beginning of development period on January 1, 1951, and notice of development period charges were issued by the Commissioner on June 30, 1950. On the Newlands project, Nevada, land reclassification field work was completed on the class 5 lands.

A memorandum of understanding among regions 1, 4, 6, and 7 of the Bureau and the University of Wyoming on October 13, 1949, established a uniform method of conducting joint studies and investigations by the Bureau and the University on existing and potential Reclamation projects. On July 28, 1949, region 4 executed an agreement with the Soil Conservation Service for the cooperative conduct of topographic, conservation, and land-classification surveys and on December 20, 1949, executed a memorandum of understanding with the same agency on land development, both on the Eden project. On June 1, 1950, regions 4 and 7 entered into a memorandum of understanding with agencies of the State of Colorado, the United States Department of Agriculture, and other agencies of the United States Department of the Interior regarding soils surveys and land-classification surveys in Colorado.

Joint studies and investigations continued on the lower cost canal-lining program under cooperative agreements with the Soil Conservation Service and the Utah Agricultural Experiment Station.

Soil- and moisture-conservation measures undertaken in cooperation with Bureau of Land Management in the watershed above Grand Valley project works have been effective in controlling damaging runoff from a test area. Tests were made to determine the conservation of water by controlling undesirable vegetative growth above the Strawberry Reservoir, Strawberry Valley project.

For the calendar year 1949 region 4 projects reported a gross crop value of $33,631,962 from 536,812 acres of irrigated land, an average of $62.65 per cropped area.

REGION 5

General investigations.—Investigations of the Canadian River project, Texas, were completed and a report was transmitted through the Secretary of the Interior to the Bureau of the Budget. A report on the Fort Gibson project, Okla., was forwarded to the Commissioner and to local interests for study. A report on potentialities of the San Juan-Chama project, Colorado-New Mexico, was forwarded to the Commissioner and to the State of New Mexico, for study. Reports on the Washita River subbasin, Oklahoma, Canton project, Oklahoma, and the Carlsbad project, New Mexico, are being processed for early presentation to the Commissioner. West Texas project and Lower Nueces River project studies were initiated. Inventories of land and water resources in the Arkansas-Red River Basins and the Gulf Basin were continued.

Construction.—Camp and liquefied petroleum facilities were completed at Platoro Dam, San Luis Valley project, Colorado. Construction of Platoro Dam and clearing of Platoro Reservoir site continued and specifications were prepared for a gate tender's house at Platoro Dam site. Designs and specifications were issued for exploratory drilling in the San Luis Valley project. Construction was completed on the camp and liquefied petroleum facilities at Fort Sumner project, New Mexico; construction advanced on the project's main canal, pumping plant, and diversion dam; contracts were awarded for the high-line canal, drains, and laterals, and designs and specifications initiated for balance of main canal.

Construction completions were made on other jobs as follows: Three two-bedroom ditchrider houses, dike drains, laterals, and wasteway drains on the W. C. Austin project, Oklahoma; lateral unit No. 7 on the Tucumcari project, New Mexico; the Socorro and Alamogordo substations on the Rio Grande project, New Mexico–Texas, and employee housing at Alamogordo substation; protective fencing at Elephant Butte stilling basin.

End of the fiscal year found construction of the utilities system at Elephant Butte Dam in progress, road improvements and employee housing work continuing at Elephant Butte and Caballo Dams. Exploratory drilling and water testing were completed at Ezzell and Oakville Dam sites, Lower Nueces River project, Texas.

Work expected to be completed early in 1951 includes replacement of the 1,000-kilovolt-ampere substation and the 3.75-mile, 13,800-volt line serving Hot Springs, N. Mex., with a 1.5-mile, 115-kilovolt single-wood-pole line and a 3,000-kilovolt-ampere, 115-kilovolt substation. Proposed early additions to the Rio Grande project power system, to be in service in 1952, are a 79-mile, 115-kilovolt transmission line from Socorro to Albuquerque with a substation at Albuquerque, and a 50-mile, 115-kilovolt tap transmission line, from near Belen, N. Mex., to Willard, N. Mex., with a substation at Willard.

Power production.—During the fiscal year, the Rio Grande project power plant sold energy of 83,240,543 kilowatt-hours that produced revenue totaling $402,892.31. Generation was below normal due to the low water in Elephant Butte Reservoir. The Rio Grande project power system has a hydro generating plant at Elephant Butte Dam, with three 8,100-kilowatt generating units; a transmission system with 364 miles of 115-kilovolt, woodpole, H-frame line extending from the power plant to 8 substations serving 11 customers. Additions to the Rio Grande project power system to be completed in 1951 and 1952 are listed in the construction section of this report.

Operation and maintenance.—At the close of the fiscal year, operation and maintenance activities involved four projects in full operation, one water conservation and utilization project in full operation, one Warren Act contractor, and one project under construction. Farmers in region 5 grossed a total crop revenue of $53,262,235 from the 267,931 acres irrigated on 9,742 farms in 1949. The farms had a population of 49,094.

On the Rio Grande project, the 159,043 acres irrigated produced a crop value of $40,109,580 or $251.32 per cropped acre. The 17,224 acres irrigated with water delivered under a Warren Act contract on the Hudspeth project produced crops valued at $4,724,317 or $274.29 per cropped acre. Crops were valued at $3,039,814 or $144.84 per cropped acre on the Carlsbad project where 20,988 acres were irrigated. During the year, facilities were completed to serve the 49,972 irrigable acres on the W. C. Austin project; the 35,841 acres irrigated in 1949 produced crops valued at $3,087,411 or $85.16 per cropped acre. The 22,509 acres irrigated on the Tucumcari project produced crops valued at $1,177,834 or $52.33 per cropped acre, and facilities were completed to serve the project's 42,321 irrigable acres. On Balmorhea project, 7,411 acres irrigated produced crops valued at $795,723 or $107.37 per cropped acre. On the Fort Sumner project 4,915 acres irrigated produced crops valued at $327,556 or $66.64 per cropped acre; this project continued under construction.

The soil- and moisture-conservation program included construction of detention dams and diversion terraces on Lake Altus Reservation, W. C. Austin project; construction of detention dams and diversion terraces in the Alamogordo Reservoir area; salt cedar spraying and mechanical clearing for water conservation in MacMillan Reservoir delta and inflow area, Calsbad project; plans and estimates were prepared for protective measures on Lucero Arroyo, Rio Grande project. The Carlsbad project, excepting Alamogordo Dam and Reservoir, was transferred to the Carlsbad irrigation district on October 1, 1949.

REGION 6

General investigations.—Investigations to obtain material for basin reports were carried forward on 33 divisions. During the fiscal year, two interim reports, on the Upper Marias and Missouri-Souris Divisions, were prepared. One special and one division report are scheduled for submission in fiscal year 1951 and three division reports in fiscal year 1952. Twelve definite plan reports were processed, with seven being submitted to the Commissioner for approval. By the close of the year, the Keyhole report had been approved, and the reports for Owl Creek, Fort Clark, Lower Marias and Yellowtail units were approved with reservations which required some revision of the reports. Twenty-one definite plan reports are scheduled for submission to the Commissioner in fiscal year 1951 and 10 in fiscal year 1952.

Construction.—The following construction was completed by contract during the fiscal year: Bridge superstructure, Boysen unit; Angostura Dam; clearing reservoir area and Heart Butte Dam, Heart Butte unit; Government camp, Keyhole unit; clearing reservoir area, Dickinson unit; relocation of county road, Canyon Ferry unit; pumping plant, canals and laterals, Savage unit; Government camp, Moorhead unit; miscellaneous work on Government camp and relocation of Forest Service buildings, Canyon Ferry unit; canal and lateral system (stations 1659 to 2560), some canal lining on Pilot and Wyoming canals and North Pavillion lateral system, Riverton project; access road for Shoshone power plant, Shoshone project; main canal relocation, Painted Woods Creek drain and miscellaneous structures, Buford-Trenton project; and Fort Peck-Williston-Garrison transmission lines. Contracts for the Circle and Savage substations and relocation of the Chicago, Burlington & Quincy Railroad at Boysen were substantially completed at the close of the year.

Construction progress during the fiscal year and to date on major contracts carried over from fiscal year 1949 and continuing into future fiscal years follows: Dickinson Dam, 82 percent completed during the year with 95 percent of the total contract completed by June 30; Shadehill Dam, 48 and 58 percent; Canyon Ferry Dam and power plant, 20 and 21 percent; and Boysen Dam and power plant, 15 and 75 percent.

New construction contracts were awarded on Keyhole Dam; temporary housing at Chester and Government camp and access road at Tiber Dam site, Lower Marias unit; additional temporary housing, Canyon Ferry unit; Williston, Miles City, Thermopolis and Havre substations; clearing of Shadehill Reservoir area; Boysen-Thermopolis, Alcova-Boysen, Jamestown-Edgley, Edgley-Forman, Voltaire-Rugby-Devils Lake-Carrington, Leeds-Rolla, Garrison-Washburn-Bismarck, and Havre-Shelby transmission lines. At the close of the fiscal year, specifications had been issued for the Rugby, Devils Lake, Jamestown, Rudyard and Shelby substations and the Bismarck-Dowson-Jamestown transmission line.

In fiscal year 1951 construction work is scheduled to start on such major features as Anchor Dam, Bixby Dam, Missouri Diversion Dam, Angostura power plant; irrigation facilities for Angostura, Heart Butte, Fort Clark, N-Bar-N and Cartwright units; and several transmission lines and substations.

In fiscal year 1952, construction is scheduled to start on Cannonball Dam; Yellowtail Dam and power plant; pumping plants for Charlie Creek, Nickwall, Sadie Flat and Sidney units; and several additional major transmission lines and substations.

Operation and maintenance.—The eleven operating projects in the region, receiving a full water supply from Bureau works, produced a gross crop valued at $18,445,610 as compared to $18,161,000 in 1948. During the fiscal year, public drawings were held for 104 public land farm units, comprising 12,073 acres, on the Shoshone project, and 50 farm units, comprising 5,912 acres, on the Riverton project. Public notice No. 30, Riverton project, was issued March 4 and opened to homestead settlement 54 farm units comprising 6,940 acres. The Savage unit, comprising 2,218 acres, was completed and was the first unit of the Missouri River Basin project to receive water.

The Marias irrigation district was established and work progressed in organizing the Angostura and Buford-Trenton irrigation districts as required by State law.

Amendatory repayment contracts were executed with the Belle Fourche and Deaver (Shoshone project) irrigation districts. The Secretary of Interior approved as to form the amendatory contracts with the Malta and Glasgow irrigation districts of the Milk River project. Negotiations were under way for an amendatory contract with the Midvale irrigation district, Riverton project. The board of commissioners of the Buffalo Rapids irrigation district No. 1, Buffalo Rapids project, passed a resolution approving and confirming the form of a proposed amendatory repayment contract.

A new repayment contract with the Willwood irrigation district, Shoshone project, and a water service contract with the city of Dickinson, N. Dak., were executed. The board of directors of the Belle Fourche irrigation district approved as to form a repayment contract for supplemental water from Keyhole Reservoir. The repayment contract with the Owl Creek irrigation district was executed by the district, but required court confirmation at the close of the year. The directors of the Fort Clark irrigation district approved the form of their repayment contract by resolution. The repayment contract of the Heart River irrigation district, Heart Butte unit, is under consideration by the landowners. A water service contract was being developed with the city of Belle Fourche for a supplemental water supply from Keyhole Reservoir.

Contracts for the repayment of rehabilitation and betterment work were executed with the Malta, Harlem, Paradise Valley, Alfalfa Valley, Zurich, and Fort Belknap irrigation districts of the Milk River project; the Willwood and Deaver irrigation districts, Shoshone project; the Midvale irrigation district, Riverton project; and the Belle Fourche irrigation district, Belle Fourche project.

Operation and maintenance of the Midvale irrigation district, Riverton project, is scheduled to be turned over to the water users January 1, 1951.

Power production.—During the fiscal year, 38 contracts involving sale of power to REA cooperatives, irrigation districts and utilities within the region, were completed. The number of REA cooperatives in the region served directly with Federal power increased from 22 to 31. Total power revenues for fiscal year 1950 were $1,524,808 as compared to $1,455,785 for fiscal year 1949. Generation by Federal hydroelectric power plants in the region, for which the Bureau markets the power, increased from 446.7 million kilowatt-hours in fiscal year 1949 to 471.4 in fiscal year 1950.

REGION 7

General investigations.—Investigation reports of the various basins have been coordinated by the region to allow the maximum efficiency in the preparation of the various basin reports. Prior to the beginning of the fiscal year, the Lower Platte River Basin report and the interim report of the Blue-South Platte and the Gunnison-Arkansas projects were completed, reproduced, and submitted to all interested State and Federal agencies for their review and comment. Comments from the agencies were received on the Lower Platte River Basin and the Gunnison-Arkansas projects reports; these reports are being reproduced for final submission to the Commissioner. Comments of the State of Colorado on the Blue-South Platte project have not been received.

These two projects in Colorado are dependent upon the transmountain diversion of Colorado River water and the authorization of the projects and subsequent construction will depend upon the division of water made available under the Colorado River Basin compact between the eastern and western slopes. The construction of project facilities will tend to solve the problem posed by irrigation and municipal water deficiencies in Colorado east of the Rockies and provide generation of a large bloc of sorely needed hydroelectric power, as well as flood control and sedimentation benefits.

Work was continued on the Kansas River and South Platte River Basin reports which consists of completing reports already under way on the South Platte, and the Republican, and Smoky Hill River Basins, together with additional studies on the Blue and Lower Kansas River area. Investigations of the Niobrara and North Platte River Basins' potentialities were continued and are expected to be completed during fiscal year 1951.

Land classification of project lands was continued to bring data up to date and to provide a more detailed basis for specific units. In this connection, contracts have been made with various State education institutions in Kansas, Nebraska, and Wyoming to provide much of the technical personnel needed in making the various classifications desired. Additional topographic surveys and drilling to determine the character of subsurface formations have been made at various dam sites, reservoir areas, and along the expected reaches of canal lines. An extensive investigation program, relative to riprap and aggregate substitutes, and loess soil has been started in the Kansas River Basin.

Assistance was given to the local interests in Nebraska, Colorado, and Kansas in the promotion and formation of irrigation districts that in the end repayment contracts might be more easily executed.

Construction.—Activities were widespread throughout the region and a greater volume of work was accomplished than in any other year, despite several labor strikes affecting construction workers and the railroad delivering materials to Bonny and Cedar Dams. Major highlight was the dedication of Kortes Dam in the month of May by President Truman, and the subsequent placing of 12,000 kilowatts of sorely needed power into commercial operation. Some 51 major construction contracts totaling $120,000,000 were in force, including 7 major dams, 67 miles of canals, 7 miles of tunnels, 725 miles of transmission lines.

At close of the fiscal year, the Colorado-Big Thompson project was estimated to be 65 percent complete, and work was finished on the Granby and Olympus Dams and the Horsetooth Reservoir. A project feature was construction of the Estes Park-Granby transmission line through the 13-mile Alva B. Adams tunnel, using three cables encased in a pressurized nitrogen-filled tube. Suspension of the line from the roof of the tunnel saved construction of about 10 miles across Gore Pass and eliminated hazardous operation and maintenance of the line in winter.

Four years of construction on the vast Missouri River Basin project shows tremendous results. One generating unit of the power plant of almost-complete Kortes Dam in the North Platte River Canyon, 2 miles below Seminoe Dam, was placed in operation; Enders and Medicine Creek Dams and one 12-mile section of Cambridge Dam, all in the Kansas River district, were completed while construction on the Superior-Courtland Diversion Dam and one 12.6-mile section of Superior canal neared completion in the same district.

Work was well advanced on the remaining 24 miles of Superior canal and the first section of Courtland canal, both in Bostwick division; one section of Cambridge canal in Frenchman-Cambridge division; and foundation work of Trenton Dam. Construction work was accelerated on Bonny and Cedar Bluff Dams started in 1949, to the extent that $6.0 million additional funds were requested to keep abreast of contractual operation. Bonny Dam is expected to be completed during fiscal year 1950, 12 months ahead of contract time allowed.

End of the fiscal year found just-awarded contracts made for Carter Lakes Dam and pressure tunnel on the Colorado-Big Thompson and Trenton Dam in Frenchman-Cambridge division; and the following in the invitation-to-bid stage: relocation of the railroad and Highway 34 around Trenton Dam and the Sidney-Ogalalla transmission line.

While most construction projects showed relatively good progress, others were unable to proceed with scheduled operations because of difficulties beyond control. The Glendo and Narrows units, scheduled for start of construction in the spring of 1949, were further delayed until the spring of 1952 because of uncertain support of State groups over the amount of water available for the reservoir. The other sections of the Courtland canal, the Republic Diversion Dam, and other features on the Bostwick division, failed to reach the design stage because of questions raised over the legality of the present Kansas irrigation laws.

Power production.—The four hydroelectric power plants in the region—Seminoe, Guernsey, and Lingle power plants of the North Platte River district, and Green Mountain Dam and power plant in South Platte River district—generated 290,000,000 kilowatt-hours of electrical energy. Of this amount, 258,000,000 kilowatt-hours were sold to municipalities, REA cooperatives, industrial plants, and public utilities for gross revenue of $2,112,400.

The outstanding problem in the region has been the rapid rate of load growth to be cared for by the existing power plants. Very little relief could be expected until May of this year when the first unit of the Kortes power plant with its 12,000 kilowatts installed capacity was put into operation. The second unit of this power plant is expected to be in operation in July and the third one in December 1950. The Estes power plant with its 45,000 kilowatt installed capacity, and the Marys Lake plant with 8,000 kilowatts, are scheduled for completion about August 1950. Completion of these three plants will tend to minimize the problem.

Operation and maintenance.—No new group of facilities were completed on the various projects within the region that would serve additional acreages with irrigation water. Construction of the lateral system in Frenchman-Cambridge division has been retarded pending confirmation by the District Court of the repayment contract with Frenchman-Cambridge irrigation district.

At the close of the fiscal year, irrigation reached a total of 257,000 acres, approximately 236,000 acres on North Platte project; 7,000 acres on Kendrick project; 12,000 acres on Mirage Flats project; and 2,675 on Frenchman-Cambridge division of the Missouri River Basin project. Also, supplemental water was delivered to 24,000 acres of the Northern Colorado Conservancy District, and 110,000 acres of Warren Act land in North Platte project.

The regional office is preparing, for completion early in fiscal year 1951, an amendatory repayment contract for a district of the Kendrick project to adjust the existing unrealistic situation. The present contract provides for payment at the rate of $2.00 per acre for 40 years for 35,000 acres. A reappraisal of the situation indicates that there are only 21,000 acres of repaying lands with a repayment ability of less than $1.00 per acre.

Division of Power

Walton Seymour, *Director*

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THE DIVISION OF POWER, a staff agency, assists the Secretary in the supervision of all the electric power activities of the Department. The growing power business is one of the major responsibilities of the Secretary of the Interior.

In the Department there are four principal power marketing agencies and five other agencies with minor power problems.

The principal power marketing agencies are: (1) Bureau of Reclamation, which operates in the 17 Western States; (2) Bonneville Power Administration, operating in Washington, Oregon, Idaho and Western Montana; (3) Southwestern Power Administration, which markets power in Louisiana, Arkansas and portions of Missouri, Kansas, Oklahoma and Texas; and (4) Southeastern Power Administration, a new organization, operating in West Virginia, Virginia, Kentucky, Tennessee, North Carolina, South Carolina, Georgia, Florida, Alabama and Mississippi.

These agencies market power produced at projects of the Bureau of Reclamation and the Corps of Engineers of the Department of the Army.

Other Department agencies whose power problems are of concern to the Division of Power are the Bureau of Indian Affairs, the Division of Territories, the Bureau of Mines, the Bureau of Land Management, and the National Park Service.

In addition to its staff functions in assisting the Secretary, the Division of Power carried on the necessary preliminary work incidental to the marketing of power from dams constructed by the Corps of Engineers in the Southeastern States, which it has been doing for the past several years. It assisted in setting up the Southeastern Power Administration which was established by Secretarial Order on March 22, 1950, at which time the Division assumed its staff responsibilities with respect to this agency.

The power activities of the Department are carried out under policies laid down by the Congress over the past four decades. The fundamental principles of these policies can be summed up as follows: (1) Dams shall be constructed which shall, where feasible, include facilities for generating electrical energy; (2) Preference in the sale of power is to be given to public bodies and cooperatives; (3) The power is to be sold on a basis which will assure its widespread use at the lowest possible rates consistent with sound business principles; (4) Power disposal shall be for the particular benefit of domestic and rural consumers; (5) Power is to be sold at rates which will return the investment plus interest to the Treasury over a specified period of years; and (6) Power disposal shall be such as to encourage widespread use and to exclude monopolization.

The Department and all its agencies engaged in power activities have firmly supported these principles and are guided by them in all of their marketing functions.

The electric power business of the Department of Interior has grown substantially since the end of World War II. During fiscal year 1950 the power agencies of the Department marketed 24.1 billion kwh with revenues from these activities of over $59,800,000, an increase of 6.6 percent in sales and 11.4 percent in revenues over 1949. With the completion of projects now under construction this rate of growth will increase materially over the next few years.

Bonneville Power Administration

Paul J. Raver, *Administrator*

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MANAGEMENT

POWER PRODUCTION, ELECTRIC ENERGY SALES, AND NET REVENUES reached new highs with the close of fiscal year 1950 but found the region ill-prepared to meet the emergency developing with the Communist invasion of South Korea and American intervention. Critical loading of transmission facilities and deferred maintenance continued to jeopardize accepted standards of service stability and reserve transmission capacity. A continued shortage of power even with scheduled new generation appeared inevitable for the next several years. Difficulties are anticipated in meeting normal load growth of the region without considering the potentially urgent power demands of a defense economy.

During the fiscal year the Administration continued to work closely with the Columbia Basin Interagency Committee, the Pacific Northwest Utilities Conference Committee, and with the Northwest Power Pool to serve present and potential power needs. Particularly significant was the coordination of power requirements of the region with current revisions of multipurpose dam and generation installation schedules of the Corps of Engineers and Bureau of Reclamation.

Transmission Economies

System operations and engineering advances continued to effect substantial economies in costs of high voltage transmission. Current comparisons reflect a reduction of nearly 40 percent in the cost of power transmission per kilovolt-ampere-mile since 1940, even though cost of materials and labor has nearly doubled during the same period. Principal contributing factors in this achievement were engineering improvements in the fields of transformer, circuit breaker, series capacitor and substation construction, together with development of light steel towers and improved relaying.

ENERGY PRODUCTION

Electric energy produced at Bonneville and Grand Coulee power plants during fiscal year 1950 totaled over 14,000,000,000 kilowatt-hours. The generation of energy by the Federal Columbia River power system was about 10 percent less than generation by the Tennessee Valley Authority, the only system in the United States, either publicly owned or privately owned, with generation larger than the Columbia River system.

The total generation of 14,140,833,500 kilowatt-hours represented an increase of 9 percent over fiscal year 1949 and constituted over 50 percent of total power production in the Pacific Northwest region during the 12-month period.

Table 1, generation at Bonneville and Grand Coulee plants, shows energy production by years from the beginning of operations to the end of fiscal year 1950. The monthly peak and average production for the same period of time is shown in chart 1 together with the combined installed generation capacity. It can be noted that maximum system demands during the last 4 years have continuously exceeded the name plate rated generating capacity.

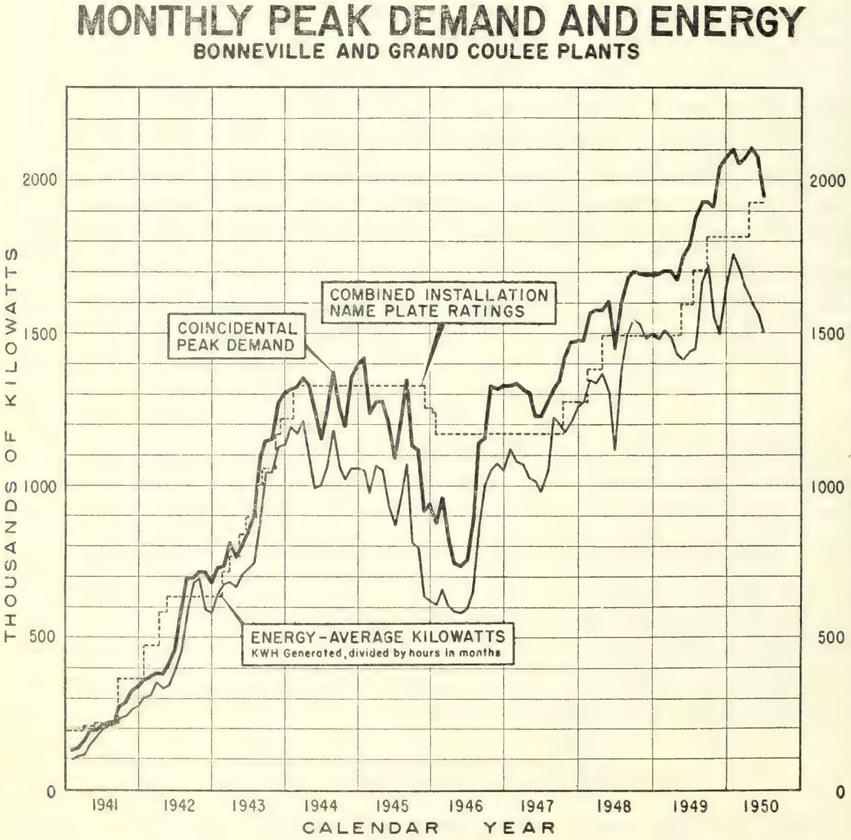

CHART 1

TABLE 1.—*Generation at Bonneville and Grand Coulee plants for Bonneville Power Administration, fiscal years 1939–50*

[Thousands of kilowatt-hours]

Fiscal years ending June 30—	Bonneville generation	Grand Coulee generation	Total generation for Bonneville Power Administration	Fiscal years ending June 30—	Bonneville generation	Grand Coulee generation	Total generation for Bonneville Power Administration
1939	34, 874		34, 874	1946	2, 674, 834	3, 561, 329	6, 236, 163
1940	208, 426		208, 426	1947	3, 695, 255	5, 058, 482	8, 753, 737
1941	894, 177	7, 455	901, 632	1948	3, 991, 860	6, 894, 047	10, 885, 907
1942	1, 807, 309	741, 844	2, 549, 153	1949	3, 868, 558	9, 057, 230	12, 925, 788
1943	2, 801, 480	2, 816, 956	5, 618, 436	1950	3, 689, 309	10, 451, 524	14, 140, 833
1944	3, 488, 874	5, 750, 950	9, 239, 824				
1945	3, 391, 128	5, 660, 446	9, 051, 574	Total	30, 546, 084	50, 000, 263	80, 546, 345

NEW SYSTEM PEAK

The maximum coincidental demand of the Administration's system on the Bonneville and Grand Coulee plants was 2,106,000 kilowatts on January 4, 1950. This demand represents an increase of 1 percent over the system peak during the preceding fiscal year. Installation of 3 new units was completed at Grand Coulee during the fiscal year, making a total of 13 units installed at that plant. Addition of these units brought the total installed generating capacity at the two Columbia River plants to 1,922,400 kilowatts name plate rating, with safe continuous capacity under favorable operating head conditions of 2,124,000 kilowatts.

ENERGY RECEIPTS AND DELIVERIES

Electric energy receipts and deliveries on the Bonneville Power Administration transmission system cover numerous types of transactions in addition to receipts from generation at Bonneville and Grand Coulee and deliveries by sales. Since the transmission grid is operated as a part of the interconnected transmission system of the public and privately owned utilities operating as the Northwest Power Pool, substantial quantities of energy are received and delivered as transfers for other utilities. Energy receipts also include receipts from storage by the Administration in non-Federal reservoirs or for storage by non-Federal utilities in Grand Coulee. Energy deliveries include deliveries from storage in Grand Coulee or to storage on other systems, energy used by the Administration and energy losses in transmission and transformations. A summary of total energy receipts and deliveries is shown in table 2, Electric Energy Account, page 116.

TABLE 2.—*Bonneville Power Administration electric energy account, fiscal year ended June 30, 1950*

Energy received (thousands of kilowatt hours):	
Energy generated for Bonneville Power Administration:	
Bonneville	3,689,309
Grand Coulee	10,451,524
Total	14,140,833
Power purchased and interchanged in	836,704
Total received	14,977,537
Energy delivered (thousands of kilowatt hours):	
Sales	13,032,173
Power interchanged out	724,273
Used by Administration	15,153
Total delivered	13,771,599
Energy losses in transmission and transformation	1,205,938
Losses as percent of total energy received	8.1
Maximum demand on Bonneville and Grand Coulee plants (kilowatts) Jan. 4, 1950, 5–6 p. m., Pacific Standard Time	2,106,000
Load factor, total generated for Bonneville Power Administration, percent	76.7

SALES EXCEED 13 BILLION KILOWATT-HOURS

Energy sales by the Bonneville Power Administration to its customers during fiscal year 1950 exceeded 13 billion kilowatt-hours, an increase of 9 percent over the preceding year. Energy losses in transmission and transformation of power were 1.2 billion kilowatt-hours or 8.1 percent of total energy received by generation, purchase, or interchange.

The increase in energy sales to publicly and privately owned utilities was 13.6 percent over the preceding year. The increase in sales to all industries was 5.1 percent with an increase in sales to the aluminum industries of 3.5 percent. A substantial portion of the increase in power supplied to the aluminum industries represented interruptible power that the Administration was able to supply because of favorable water conditions.

During the 12 years' operation ending June 30, 1950, the Administration has delivered 75,353,895,000 kilowatt-hours of energy at a composite rate of 2.44 mills per kilowatt-hour. Sales to publicly owned utilities for the 12-year period were 10.3 billion kilowatt-hours at an average rate of 2.81 mills. Privately owned utilities received 19.3 billion kilowatt-hours at an average rate of 2.41 mills, and industries 45.8 billion kilowatt-hours at an average rate of 2.37 mills. Power sales to the aluminum plants, initially established in the Pacific

Northwest primarily to meet World War II production needs, were 39.2 billion kilowatt-hours at an average rate of 2.23 mills. Sales to industry other than aluminum, including sales to military establishments, were 6.6 billion kilowatt-hours at an average rate of 3.22 mills.

Electric energy sales by class of customer for each of the years are shown in table 3. A further summary of sales classified by rate schedule is shown in table 4. Approximately three-fourths of energy sales

TABLE 3.—*Electric energy sales by class of customer, fiscal years 1939–50*

[Thousands of kilowatt-hours]

Fiscal years ending June 30—	Industry		Publicly owned utilities	Privately owned utilities	Total
	Aluminum	Other industry [1]			
1941 and prior	522, 982	4, 829	35, 242	536, 555	1, 099, 608
1942	1, 845, 249	79, 155	142, 491	357, 704	2, 424, 599
1943	3, 588, 848	507, 196	435, 289	739, 076	5, 270, 409
1944	5, 453, 893	1, 022, 477	727, 642	1, 467, 304	8, 671, 316
1945	4, 667, 381	964, 724	823, 822	2, 057, 203	8, 513, 130
1946	2, 492, 985	799, 378	635, 531	1, 902, 990	5, 830, 884
1947	4, 212, 413	626, 688	1, 044, 784	2, 377, 887	8, 261, 772
1948	4, 902, 465	646, 913	1, 561, 436	3, 176, 732	10, 287, 546
1949	5, 665, 746	880, 017	2, 082, 619	3, 334, 076	11, 962, 458
1950	5, 863, 465	1, 016, 402	2, 840, 529	3, 311, 777	13, 032, 173
Total to June 30, 1950	39, 215, 427	6, 547, 779	10, 329, 385	19, 261, 304	75, 353, 895

[1] Includes military establishments.

TABLE 4.—*Electric energy sales by rate schedules, fiscal year ended June 30, 1950*

Rate schedule	Energy	Revenue [1]	Mills per kilowatt-hour
	Thousands of kilowatt-hours		
C–2, C–3, C–4:			
Industries	6, 483, 701	$13, 438, 993	2. 07
Utilities	3, 657, 018	8, 496, 333	2. 32
Subtotal	10, 140, 719	21, 935, 326	2. 16
F–2, F–3, F–4:			
Industries	251, 294	930, 184	3. 70
Utilities	128, 843	580, 018	4. 50
Subtotal	380, 137	1, 510, 202	3. 97
A–3, A–4: Utilities	18, 425	59, 710	3. 24
E–2, E–3, E–4: Utilities	1, 756, 301	5, 680, 228	3. 23
Experimental, H–1, H–2, H–3, and exchange (industries and utilities)	736, 591	1, 841, 478	2. 50
Total sales	13, 032, 173	31, 026, 944	2. 38
Reconciliation with accounting records		[1] +354, 750	
Other electric revenues		362, 903	
Total operating revenues		31, 744, 597	

[1] Sales statistics include billing adjustments or revisions made subsequent to close of accounting records.

Major features of rate schedules:

C–2, C–3, C–4: Kilowatt-year rate for transmission system firm power.
F–2, F–3, F–4: Demand-energy rate for firm power.
A–3, A–4: Kilowatt-year rate for at-site firm power.
E–2, E–3, E–4: Demand-energy rate for firm power for resale to ultimate consumers.
Experimental: Energy rate of 2.5 mills for developmental purposes.
H–1, H–2, H–3: Energy rate for dump, emergency, or breakdown service.
Exchange: Gross exchange account deliveries at dump energy rate.

during the fiscal year were made under the C schedule, at an average rate of 2.16 mills. This is the kilowatt-year rate for firm power delivered at any point from the transmission system. Sales are generally made under this rate to industries operating at high load factor and to utilities having substantial generating facilities.

New Customers Added

At the end of fiscal year 1950 the Administration served 103 customers, including 73 publicly owned distributors of power, 19 industrial customers, 4 military establishments, and 7 privately owned utilities. Nine customers were added during the year—two public utility districts, three cooperatives, one State institution, one privately owned utility, and two industries. Service to two industries was discontinued during the year. Energy deliveries during the fiscal year to each individual customer are shown in table 5.

TABLE 5.—*Energy deliveries to customers of the Bonneville Power Administration, fiscal year ended June 30, 1950*

	Energy deliveries for year,[1] kilowatt-hours
Publicly owned utilities:	
Municipalities:	
Bandon, Oreg	3, 356, 880
Canby, Oreg	6, 472, 800
Cascade Locks, Oreg	6, 940, 800
Centralia, Wash	2, 700, 410
Cheney, Wash	9, 185, 300
Drain, Oreg	6, 084, 000
Ellensburg, Wash	15, 968, 975
Eugene, Oreg	62, 099, 130
Forest Grove, Oreg	22, 560, 000
Grand Coulee, Wash	22, 221, 600
McMinnville, Oreg	35, 543, 000
Milton, Oreg	8, 907, 600
Monmouth, Oreg	6, 822, 024
Seattle, Wash	230, 574, 000
Tacoma, Wash	441, 179, 000
Total municipalities (15)	880, 615, 519
Public utility districts:	
Benton County public utility district No. 1	57, 044, 799
Central Lincoln public utility district	49, 231, 087
Chelan County public utility district No. 1	129, 920, 120
Clallam County public utility district No. 1	51, 691, 581
Clark County public utility district No. 1	261, 211, 415
Clatskanie public utility district	8, 067, 600
Cowlitz County public utility district No. 1	219, 606, 227
Douglas County public utility district No. 1	10, 160, 700
Ferry County public utility district No. 1	100, 095

[1] Includes energy deliveries carried on exchange accounts.

Publicly owned utilities—Continued	*Energy deliveries for year, kilowatt-hours*
Public utility districts—Continued	
Franklin County public utility district No. 1	42, 216, 920
Grant County public utility district No. 2	82, 707, 527
Grays Harbor County public utility district No. 1	146, 405, 600
Kittitas County public utility district No. 1	3, 799, 200
Klickitat County public utility district No. 1	28, 089, 000
Lewis County public utility district No. 1	71, 404, 026
Mason County public utility district No. 3	55, 391, 160
Northern Wasco County public utility district	3, 197, 400
Okanogan County public utility district No. 1	57, 474, 786
Pacific County public utility district No. 2	40, 586, 843
Pend Oreille County public utility district No. 1	24, 757, 315
Skamania County public utility district No. 1	13, 710, 600
Snohomish County public utility district No. 1	307, 402, 488
Tillamook County public utility district	14, 807, 237
Wahkiakum County public utility district No. 1	8, 551, 200
Total public utility districts (24)	1, 687, 534, 926
Cooperatives:	
Benton-Lincoln Electric Cooperative	27, 164, 876
Benton Rural Electric Association	16, 020, 891
Big Bend Electric Cooperative	8, 728, 349
Blachly-Lane County Electric Cooperative	3, 765, 600
Central Electric Cooperative	4, 955, 220
Chelan County Electric Cooperative	462, 960
Clearwater Valley Light and Power Association	16, 560, 150
Columbia Basin Electric Cooperative	649, 800
Columbia County REA	8, 068, 050
Coos-Curry Electric Cooperative	5, 289, 000
Douglas Electric Cooperative	13, 817, 464
Eastern Oregon Electric Cooperative	300, 600
Hood River Electric Cooperative	7, 972, 800
Idaho County Light and Power Association	3, 445, 450
Inland Empire RE Inc	35, 282, 100
Kootenai County REA	6, 615, 410
Lane County Electric Cooperative	12, 691, 404
Lincoln Electric Cooperative	10, 004, 860
Missoula Electric Cooperative	487, 733
Nespelem Valley Electric Cooperative	4, 518, 299
Northeast Clackamas Electric Cooperative	1, 145, 300
Northern Lights	4, 892, 700
Okanogan County Electric Cooperative	1, 808, 360
Pend Oreille Electric Cooperative	3, 216, 987
Ravalli County Electric Cooperative	532, 140
Salem Electric	20, 116, 600
Stevens County Electric Cooperative	7, 631, 484
Tanner Mutual Power and Light Association	216, 553
Umatilla Electric Cooperative	12, 067, 673
Wasco Electric Cooperative	13, 168, 146
West Oregon Electric Cooperative	8, 036, 538
Total cooperatives (31)	259, 633, 497

Publicly owned utilities—Continued	*Energy deliveries for year, kilowatt-hours*
Other:	
Oregon State College	1, 809, 600
Vanport Extension Center	372, 367
Vera irrigation district No. 15	10, 563, 000
Total other (3)	12, 744, 967
Total publicly owned utilities	2, 840, 528, 909
Privately owned utilities:	
British Columbia Electric Ry. Co	------------
Mountain States Power Co	143, 823, 719
Pacific Power & Light Co.—Astoria	71, 425, 000
Portland General Electric Co	1, 083, 384, 000
Puget Sound Power & Light Co	576, 698, 741
Washington Water Power Co.—Kootenay Lake	116, 160, 000
Washington Water Power-Pacific Power & Light Cos	838, 928, 000
Five-Company Pool	481, 357, 518
Total privately owned utilities (7)	3, 311, 776, 978
Military establishments:	
Pasco General Depot	1, 335, 600
Strategic Air Command	11, 072, 000
Tongue Point Naval Station	15, 899, 607
Velox Naval Supply Depot	3, 945, 600
Total military establishments (4)	32, 252, 807
Industries:	
Aluminum:	
Aluminum Co. of America	1, 463, 237, 200
Kaiser Aluminum & Chemical Corp.:	
Spokane Aluminum Fabrication	210, 540, 000
Spokane Aluminum Reduction	1, 966, 210, 000
Tacoma Aluminum Reduction	435, 790, 000
Reynolds Metals Co.:	
Longview	554, 328,000
Troutdale	1, 233, 360, 000
Other industries:	
Carborundum Co	45, 137, 000
Crown Zellerbach Corp	38, 545, 400
Electro-Metallurgical Co	77, 740, 000
Pacific Carbide & Alloys	23, 012, 650
Pennsylvania Salt Manufacturing Co	94, 104, 800
Rayonier Corp	13, 501, 000
Miscellaneous (9)	692, 108, 720
Total industries (21)	6, 847, 614, 770
Total sales of electric energy (104)	13, 032, 173, 464

Low Rates Increase Power Use

All long-term wholesale power contracts with distributors of Bonneville power contain provisions regarding resale rates and principles of operation to insure distribution for the benefit of the general public, and particularly domestic and rural consumers. The direct relationship of increased use of electric energy to the influence of lower rates is well illustrated in table 6. This shows the trends from 1938 to date on the average use and price for residential home and farm service in the Pacific Northwest as compared with the national average.

TABLE 6.—*Residential and rural service, average use per customer and average price per kilowatt-hour*

Calendar year	Kilowatt-hours per customer		Calendar year	Price per kilowatt-hour	
	United States total	Oregon and Washington		United States total	Oregon and Washington
				Cents	*Cents*
1938	902	1,410	1938	4.02	[1] 2.65
1939	953	1,467	1939	3.87	[1] 2.55
1940	1,006	1,589	1940	3.74	2.27
1941	1,044	1,776	1941	3.65	2.08
1942	1,088	2,024	1942	3.57	1.94
1943	1,135	2,279	1943	3.50	1.84
1944	1,225	2,504	1944	3.41	1.74
1945	1,305	2,801	1945	3.32	1.69
1946	1,418	3,219	1946	3.13	1.58
1947	1,546	3,696	1947	3.00	1.49
1948	1,674	4,160	1948	2.92	1.41
1949	1,806	4,503	1949	2.87	1.38

[1] Partially estimated from State commission data.

Source: Edison Electric Institute.

REVENUES

Gross operating revenues of the Administration for fiscal year 1950 were $31,745,000. This figure is subject to confirmation by the independent auditors. If no change is made, the total revenue for fiscal year 1950 exceeds that of the previous year by $3,900,000 and sets a new high in power sales.

Revenues increased in all customer categories. Sales to aluminum and other industries, including military establishments, increased $849,485 or 6.1 percent; to publicly owned utilities $2,515,992 or 42.7 percent, and to privately owned utilities $405,131 or 5.2 percent.

Sales to industries, as shown in table 7, page 122, accounted for 46.7 percent of the gross, publicly owned utilities for 26.5 percent, privately owned utilities for 25.7 percent and other electric revenues for 1.1 percent.

TABLE 7.—*Revenues by classes of customer through fiscal year 1950*

Class of customers	1944 and prior	1945	1946	1947	1948	1949	1950	Total to June 30, 1950	1950 percentage (dollar revenue)
Industry:									
Aluminum	$24, 350, 433	$11, 838, 156	$7, 987, 226	$9, 045, 540	$10, 453, 425	$11, 741, 530	$12, 133, 254	$87, 549, 564	38. 23
Other industry [1]	5, 185, 494	4, 171, 469	3, 108, 749	1, 836, 349	1, 915, 884	2, 219, 819	2, 677, 580	21, 115, 344	8. 43
Publicly owned utilities	3, 768, 642	2, 141, 635	1, 711, 822	2, 778, 765	4, 318, 120	5, 893, 436	8, 409, 428	29, 021, 848	26. 49
Privately owned utilities	7, 152, 532	4, 752, 021	5, 209, 344	6, 127, 669	7, 633, 051	7, 756, 301	8, 161, 432	46, 792, 350	25. 71
Other electric revenues	130, 123	86, 737	[2] 1, 867, 144	[3] 2, 102, 606	193, 230	209, 943	362, 903	4, 952, 686	1. 14
Total operating revenue	40, 587, 224	22, 990, 018	19, 884, 285	21, 890, 929	24, 513, 710	27, 821, 029	31, 744, 597	[4] 189, 431, 792	100. 00

[1] Includes military establishments.

[2] Includes $1,789,433 of contract cancellations applicable to fiscal year 1946. (The total of $3,802,415 was apportioned over a period of 12 months.)

[3] Includes $2,012,972 of contract cancellations applicable to fiscal year 1947. (The total of $3,802,415 was apportioned over a period of 12 months.)

[4] As of June 30, 1950, the Administration had collected and deposited in the U. S. Treasury power revenue receipts totaling $173,773,605 and general fund receipts of $5,505,195. Accounts receivable, accrued unbilled revenues, unbilled exchange sales, miscellaneous adjustments and minor items account for the difference between total revenues and total receipts deposited by the Administration with the U. S. Treasury.

NOTE: The figures submitted for fiscal year 1950 are subject to confirmation by the auditors.

ANNUAL AUDIT

The books and accounts of the Columbia River power system consisting of Bonneville Power Administration and the power components of Bonneville Dam project and Columbia Basin project (Grand Coulee Dam) are being audited for the sixth time by Arthur Andersen & Co. Final figures are not available, therefore the following amounts are estimated. Net operating revenues for the fiscal year 1950 are expected to reach $11,600,000 after deducting all expenses of operation, maintenance, depreciation, and interest. Gross operating revenues from the beginning of operations to June 30, 1950, will exceed $189,000,000, leaving a cumulative net revenue of about $54,200,000 as of that date after provision for all expenses, including depreciation and interest on power investment.

POWER ALLOCATIONS

The total original construction cost, including interest during construction on construction costs allocated to power, of all types of plant, i. e., power, irrigation, navigation, multipurpose, etc., will approximate $596,500,000 as of June 30, 1950. Of this amount $409,200,000 was allocated to power, including river regulation, and the remainder of $187,300,000 was allocated to irrigation, navigation, flood control, and other nonpower purposes.

In addition to this investment of $409,200,000 in the construction costs of transmission lines, dams, power plants and related facilities allocated to power, the United States Government has invested money in the operation and maintenance of these power facilities and is credited with interest on the unpaid balances of its total investment. As of June 30, 1950, the gross investment of the Government in the construction costs, operations, maintenance and interest on the power activity approached $526,000,000. This amount includes all funds appropriated exclusive of unrequisitioned balances together with indirect items such as WPA expenditures and amounts representing the net fair value of property received from or transferred to other Federal agencies without interagency transfers of funds in payment therefor. The interest accumulation included in the gross Federal investment was approximately $69,000,000 on June 30, 1950.

This gross Federal power investment is reduced by repayment of all cash receipts from power operations inasmuch as these cash receipts are covered directly into the Treasury of the United States. In other words, the projects cannot retain and use in their operations the amounts collected from power sales with the minor exception of a small continuing fund. The cumulative gross repayments to June 30, 1950, should approximate $179,000,000, leaving a net Federal investment of about $347,000,000 as of June 30, 1950, to be returned from future power operations.

TRANSMISSION SYSTEM

Key transmission facilities completed during the year substantially increase the flow of energy to power-deficit load centers of the Olympic Peninsula, Puget Sound, Portland-Vancouver and southwest Oregon areas. Most important additions to the transmission system, chart 2, included 230-kilovolt line construction from Grand Coulee to the Snohomish substation, the 115-kilovolt line from Shelton to Port Angeles, a 230-kilovolt line from Bonneville to Troutdale, and the Detroit-Lyons-Lebanon 230-kilovolt line, currently operated at 115-kilovolts. Substation facilities were completed to match the increased transmission capacity.

Circuit Miles Added

During the 1950 fiscal year, 579 circuit-miles of high-voltage lines and 15 substations were added to the Federal transmission system, comprising a total network of 4,040 circuit-miles and 108 substations serving Washington, Oregon, Northern Idaho, and western Montana. The system has 1,823 miles of 230,000-volt line, 1,913 miles of 115,000-volt line, and 304 miles of lower voltage line, as shown in chart 3.

Substation capacity, chart 4, was increased by 303,350 kilovolt-amperes, bringing the total transformer capacity to 2,765,975 kilovolt-amperes, under self-cooled conditions and a maximum of 3,389,803 kilovolt-amperes when forced-cooled. An additional 117,520 kilovolt-amperes of static capacitors was installed, bringing the capacitor total to 455,000 kilovolt-amperes. A 20,000 kilovolt-ampere synchronous condenser was added to bring total capacity for this equipment to 307,500 kilovolt-amperes.

Numerous customer service substations were energized during the year. The largest single substation addition was a third transformer bank installed at Troutdale substation. This bank has a self-cooled capacity of 150,000 kilovolt-amperes and a forced-cooled capacity of 250,000 kilovolt-amperes.

Engineering Advances

Notable economies in system design and operation were achieved by the engineering staff. Largely through efforts of Bonneville engineers, the utility industry has accepted new low levels in insulation requirements, making possible savings of as much as 10 percent in the cost of transformers, circuit breakers, and other high voltage equipment. These savings, and increased competition among manufac-

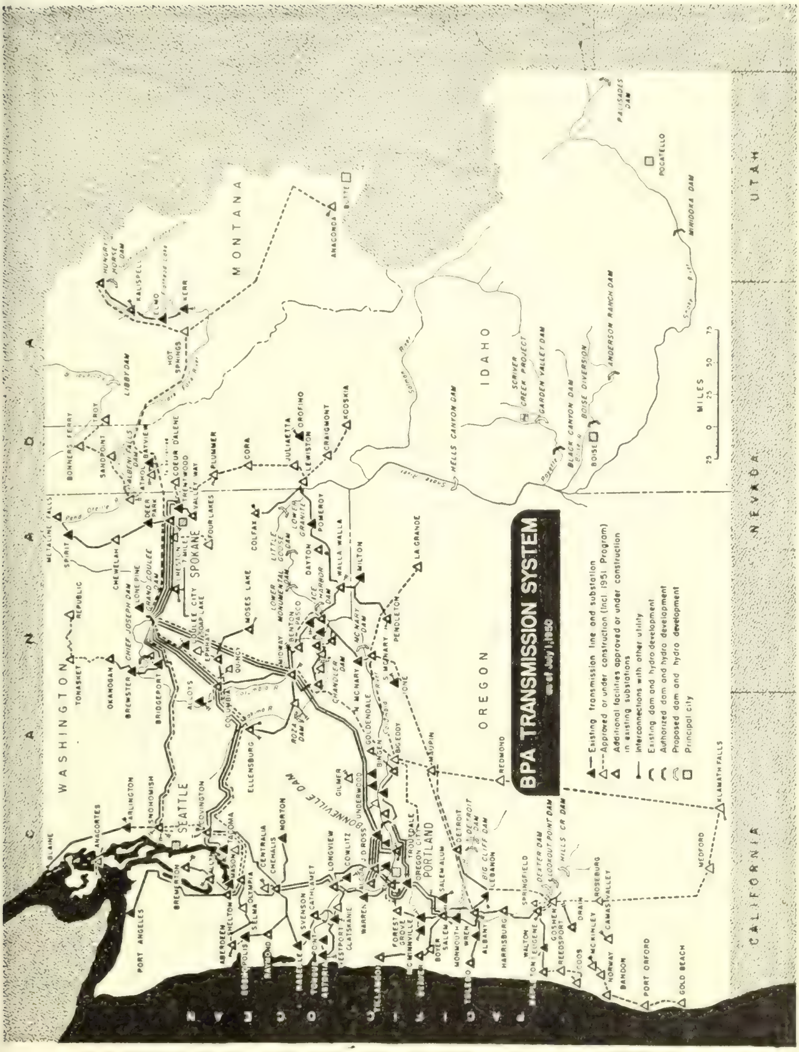
BPA TRANSMISSION SYSTEM
as of July 1, 1950
Existing transmission line and substation
Approved or under construction (Incl. 1951 Program)
Additional facilities approved or under construction in existing substations
Interconnections with other utility
Existing dam and hydro development
Authorized dam and hydro development
Proposed dam and hydro development
Principal city
C A N A D A
WASHINGTON
MONTANA
IDAHO
OREGON
CALIFORNIA
NEVADA
UTAH
P A C I F I C   O C E A N
SEATTLE
SPOKANE
PORTLAND
BONNEVILLE DAM
GRAND COULEE DAM
MILES
25 0 25 50 75

CHART 2

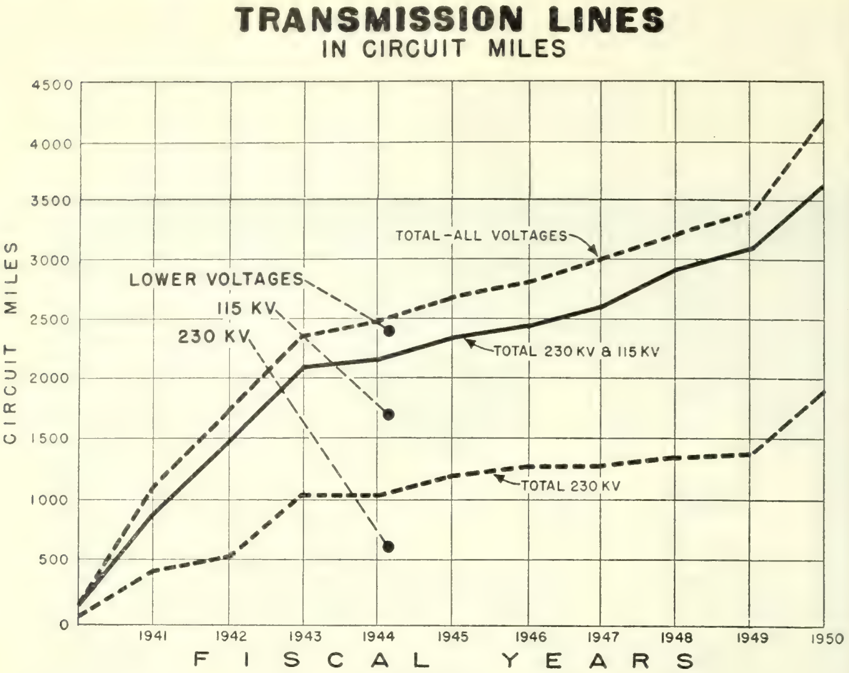

CHART 3

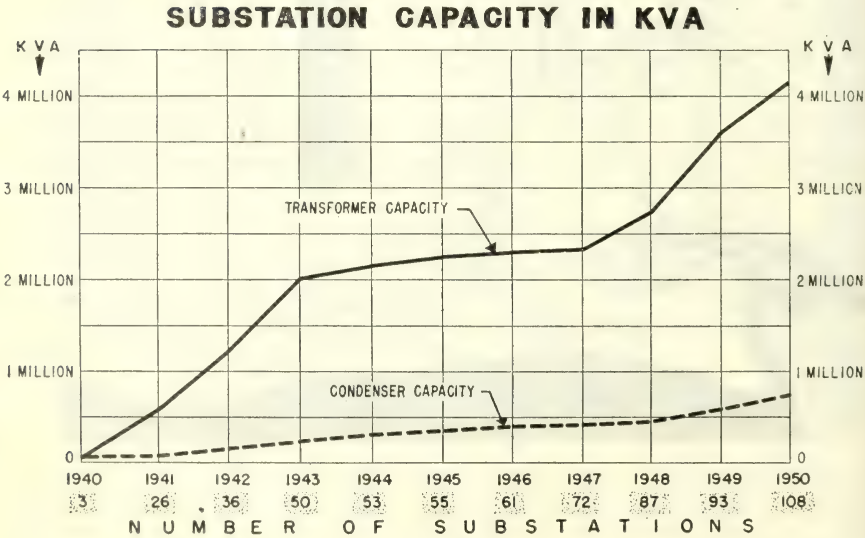

CHART 4

turers of this type of equipment have resulted in bids as much as 50 percent lower than quotations in 1947 and 1948. Costs of transmission per kilovolt-mile are nearly 40 percent lower than 10 years ago even though material costs have nearly doubled, largely due to engineering advances such as light-steel towers, and improvements in high voltage equipment, together with integrated system operation.

Lines energized during the year included:

Location	Date energized	Structure miles	Kilovolt
Detroit-Lyons	Sept. 1, 1949	21	230
Lyons-Lebanon	do	23	230
Grand Coulee-Snohomish No. 1 and No. 2	Oct. 21, 1949	136	230
Midway-Benton No. 2	Dec. 7, 1949	17	230
Bonneville-Troutdale No. 2	Dec. 10, 1949	21	230
Columbia-Grande Coulee No. 3	June 7, 1950	76	230
Grand Coulee-Foster Creek	Sept. 25, 1949	30	115
Shelton-Port Angeles	Oct. 31, 1949	82	115
Olympia-Cosmopolis	Feb. 23, 1950	41	115

OPERATION AND MAINTENANCE

Extremely heavy loading of transmission lines and inadequacies of the Administration's preventive maintenance program, emphasized in the 1949 report, resulted in costly and hazardous disruptions of system operations during fiscal year 1950. New transmission lines and substation facilities were more than offset by generation added at Grand Coulee Dam. Proposed accelerated generating schedules without adequate increases in construction and maintenance funds could easily create a critical operating problem.

Bonneville's system was seriously disrupted for prolonged periods of time on three separate occasions during the fiscal year due to unstable operating conditions. Each major disturbance could have been prevented or confined to a small area through adequate reserves of transmission facilities, better system protection equipment, and preventive maintenance.

The Administration's annual budgets and advance programs are designed to accrue a minimum amount of reserve capacity over a period of years and to improve protective systems through current development of microwave installations. Problems of carrying increased loads and providing reliable service could quickly become critically acute should a national emergency situation continue to develop. Meanwhile, all possible steps are being taken to give high priority to all proposals and methods of strengthening the system and insuring maximum stability of operation.

ADDED GENERATING CAPACITY

During the past year three additional Grand Coulee units were installed in the right powerhouse. The addition of these units increased the maximum generating capability of the system to 2,124,000 kilowatts. Five additional units will complete the installations at Grand Coulee by October 1951.

The Federal projects recommended by the Corps of Engineers and the Bureau of Reclamation are shown in table 8. These multipurpose projects are needed to meet flood control, navigation, irrigation, and power needs of the region. With complete development of the projects listed, 17.8 million acre-feet of storage space will be added to the present flood-control facilities and nearly 10.0 million kilowatts will be added to the region's power supply.

Non-Federal Additions

The non-Federal utilities have added smaller, although highly important, amounts of generating capacity to the region. During the year, Pacific Power & Light Co. added a 50,000-kilowatt unit at Ariel hydro plant and the city of Eugene added 12,500 kilowatts at the Leaburg and Walterville hydro plants, and 13,000 kilowatts at a new steam plant. In the eastern area the Idaho Power Co. added 84,000 kilowatts and the Montana Power Co. has added 56,000 kilowatts to its Kerr hydro plant. Additional improvements planned by the non-Federal utilities are shown in table 9, page 130.

Generation during fiscal year 1950 by the principal electric utility systems of the Pacific Northwest region are in table 10, page 130, and chart 5, page 131. All of the utilities are members of the Northwest Power Pool. Utah Power & Light Co. and British Columbia Electric Co. are also members of the pool but are not included since their major service areas are outside of the Pacific Northwest.

The Administration supplied 56.7 percent of the total energy requirements of the utilities serving the region. In addition to the power requirements of industries and nonpool member utilities a maximum hourly delivery of 808,000 kilowatts and 3,961,100,000 kilowatt-hours was provided by the Administration for use by the other pool utilities in meeting their requirements.

RECOMMENDATIONS

The national emergency which developed at the end of the fiscal year has emphasized the need for maintaining normal generation schedules in addition to speeding up the supply of power available in order to provide a safe margin for national security over and above normal requirements of the regional economy.

capabilities correspond to a coordinated system of operation of all plants

	Location	Plant installations,[1] kilowatts	Nominal prime power,[2] average kilowatts	Pool elevation, feet	Usable storage, acre-feet	Average head, feet	Principal purposes
Existing projects:							
Grand Coulee	Washington	[3] 1,944,000	[4] 1,549,000	1,228.0	5,212,000	330	Power, irrigation, navigation, and flood control.
Bonneville	Washington-Oregon	518,400	479,000	72.0		60	Power and navigation.
Minidoka	Idaho	13,400	6,000	4,245.0	95,200	49	Do.
Boise diversion	do	1,500	2,000	2,800.0		31	Do.
Black Canyon	do	8,000	9,000	2,947.0	14,800	94	Do.
Projects under construction:							
Hungry Horse	Montana	285,000	171,000	3,559.0	2,980,000	377	Power, irrigation, navigation, and flood control.
Chief Joseph	Washington	1,152,000	829,000	937.5		171	Power, irrigation and navigation.
McNary	Washington-Oregon	980,000	627,000	340.0		87	Do.
Anderson Ranch	Idaho	40,500	7,000	4,196.0	464,200	260	Power, irrigation and flood control
Lookout Point (Meridian)	Oregon	115,000	31,000	929.0	368,000	228	Power, irrigation, navigation and flood control.
Detroit	do	100,000	31,000	1,569.0	340,000	299	Do.
Big Cliff	do	18,000	9,000	1,197.0		81	Power.
Authorized projects:							
Libby	Montana	588,000	234,000	2,440.0	4,250,000	300	Power, flood control and navigation.
Albeni Falls	Idaho	42,600	24,000	2,062.5	1,140,000	24	Power, navigation and flood control.
Priest Rapids	Washington	1,590,000	733,000	550.0	2,100,000	129	Do.
John Day	Washington-Oregon	1,275,000	720,000	255.0	2,000,000	95	Power, navigation, irrigation, and flood control.
The Dalles	do	980,000	691,000	160.0		88	Power, navigation, and irrigation.
Ice Harbor	Washington	260,000	190,000	440.0		93	Do.
Lower Monumental	do	240,000	180,000	533.0		89	Do.
Little Goose	do	260,000	195,000	633.0		96	Power and navigation.
Lower Granite	do	220,000	158,000	715.0		77	Do.
Hills Creek	Oregon	20,000	10,000	1,510.0	221,000	204	Power, navigation, flood control and irrigation.,
Dexter	do	15,000	10,000	695.0		53	Power.
Cougar [5]	do	25,000	14,000	1,683.0	182,000	418	Power, irrigation, navigation, and flood control.
Green Peter [5]	do	81,000	20,000	984.0	322,000	315	Do.
Roza	Washington	10,000	6,000			140	Power and irrigation.
Chandler	do	12,000	10,000			118	Do.
Palisades	Idaho	112,500	39,000	5,620.0	1,200,000	144	Power, irrigation, and flood control.
Recommended projects:							
Hells Canyon	Oregon-Idaho	900,000	640,000	2,077.0	3,880,000	510	Power, navigation, and flood control.
Upper Scriver	Idaho	30,000	21,000	4,505.0		400	Power.
Lower Scriver	do	90,000	42,000	4,060.0		794	Do.
Garden Valley	do	60,000	41,000	3,266.0	843,000	280	Power, irrigation, and flood control.
White Bridge	Oregon	15,000	8,000	670.0		93	Power.

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[1] Name plate rating.
[2] Average capability during the storage draw-down period.
[3] 14 of ultimate 18 units are now in operation and 4 units are being manufactured.
[4] Pumping requirements of the Columbia Basin project have been deducted.
[5] Power facilities are not authorized.

TABLE 9.—*Generators scheduled for installation in the Pacific Northwest by non-Federal utilities, Oregon, Washington, Idaho, and western Montana*

[Thousands of kilowatts]

	Type of installation	Name plate rating	Peaking capability
Privately owned utilities:			
Idaho Power Co.:			
Bliss No. 3, No. 4	Hydro	46.0	46.0
Guffey No. 1, No. 2, No. 3	do	30.0	30.0
Plant No. 1	do	65.0	65.0
Plant No. 2	do	70.0	70.0
Plant No. 3	do	80.0	80.0
		291.0	291.0
California Oregon Power Co.:			
Toketee Falls No. 3	do	13.3	14.2
Slide Creek	do	17.0	17.0
Soda Springs	do	12.0	12.0
Upper Clearwater	do	13.0	13.0
Lower Clearwater	do	15.0	15.0
Fish Creek	do	6.0	6.0
Upper Lemolo	do	20.0	20.0
Lower Lemolo	do	20.0	20.0
		116.3	117.2
Total privately owned utilities		407.3	408.2
Publicly owned utilities:			
Seattle City Light:			
Gorge No. 4	do	60.0	40.0
Ross No. 1, No. 2, No. 3, No. 4	do	360.0	360.0
		420.0	400.0
City of Eugene:			
Leaburg No. 2	do	7.6	7.6
Eugene No. 3	Steam	13.0	13.0
		20.6	20.6
Rock Island:[1]			
No. 5, No. 6, No. 7, No. 8, No. 9, No. 10	Hydro	120.0	120.0
Total publicly owned utilities		560.6	540.6
Total all non-Federal utility installations		967.9	948.8

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[1] Contingent upon acquisition of this plant by a publicly owned utility from the Puget Sound Power & Light Co.

TABLE 10.—*Generation by the principal electric utility systems of the Pacific Northwest, fiscal year 1950*

Utilities	Kilowatt-hours	Percent of total generation	Utilities	Kilowatt-hours	Percent of total generation
Publicly owned:			Privately owned—Con.		
Bonneville Power Administration	*Billion* 14.1	*Percent* 56.7	Washington Water Power Co	*Billion* 1.3	*Percent* 5.2
Seattle City Light	1.1	4.4	Pacific Power & Light Co.	.9	3.6
Tacoma City Light	.8	3.2	Portland General Electric Co	.7	2.8
Total publicly owned	16.0	64.3	Montana Power Co	2.8	11.3
			Idaho Power Co	1.5	6.0
Privately owned:			Total privately owned	8.9	35.7
Puget Sound Power & Light Co	1.7	6.8	Total generation[1]	24.9	100.0

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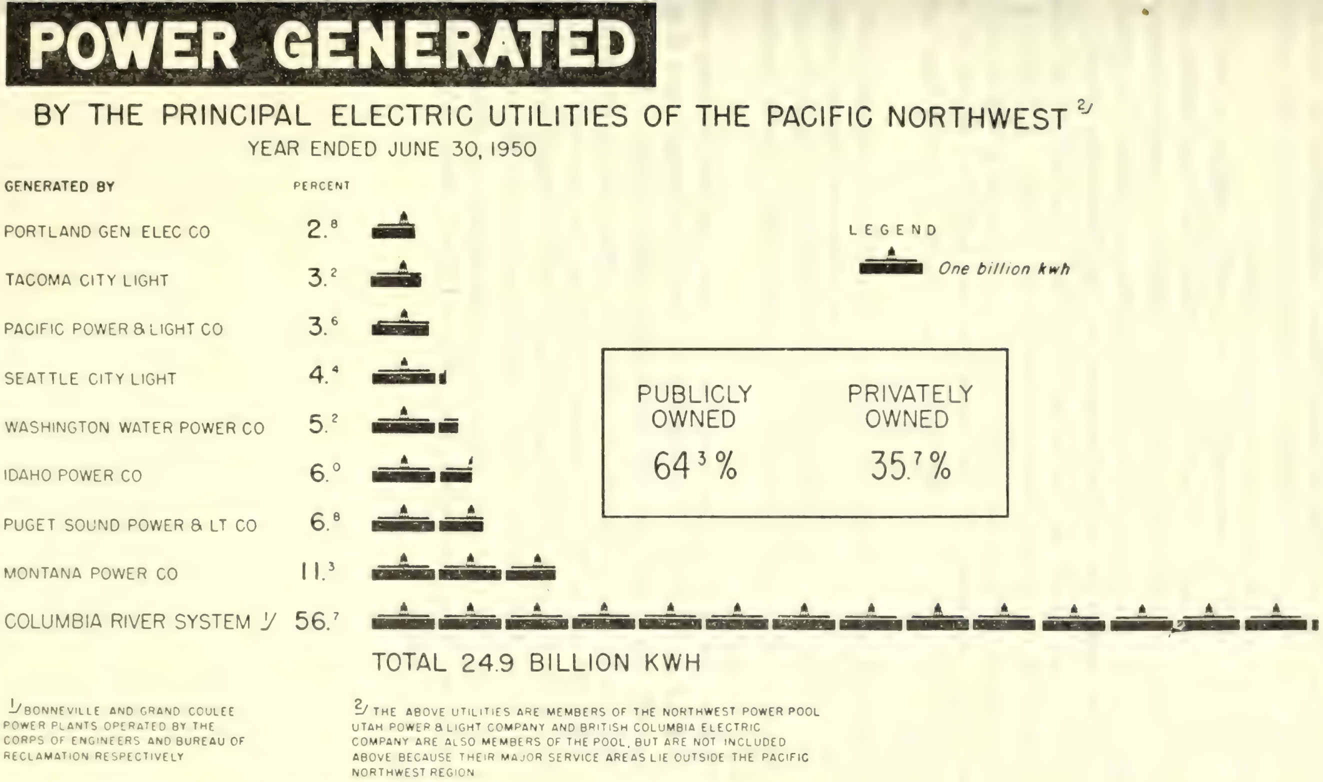
[1] The above utilities are members of the Northwest Power Pool. Utah Power & Light Co., and British Columbia Electric Co., are also members of the pool, but are not included above because their major service areas lie outside the Pacific Northwest region.



SOURCE: WEEKLY OPERATING REPORTS OF NORTHWEST POWER POOL

CHART 5

Supplementing a speeded-up program of generation, it is equally important that the program of transmission construction be accelerated in order to serve vital defense industries and other war establishments when and as new power becomes available.

In order to fulfill its responsibility as a public utility, as well as to provide the reliability of service upon which the requirements of certain strategic industries insist, the following specific recommendations, in the opinion of the Department, should be given thorough consideration by the Congress and the Executive branch:

(*a*) Adequate funds should be made available for operation and maintenance of the system commensurate with its size. A tendency not to recognize the importance of a sound maintenance program concurrent with expansion of the system cannot help but result in a consequent degrading of service which customers of the system are paying for.

(*b*) Recognition of the need for reserve transmission capacity cannot be overemphasized. System stability cannot be maintained under overload conditions. Reliability of service, therefore, demands sufficient reserve capacity to provide this needed and urgently recommended protection.

A further recommendation involves the need for clarification and revision of Federal fiscal policy by the Congress to permit more flexible and efficient operation of reimbursable public works. Further consideration by the Congress of legislative proposals for establishment of a Columbia Basin Account could go far towards a more equitable basis for fixing rates as well as simplify present irrigation subsidy procedures. Such a law should provide for fixing rates and returning reimbursable costs on a pooled basis to correspond to the present integrated operation of the United States Columbia River power system.

Southwestern Power Administration

Douglas G. Wright, *Administrator*

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THE INSTALLATION OF TWO NEW GENERATORS, one at Denison Dam project, and one at Norfork Dam project, gave Southwestern Power Administration an additional 70,000 kilowatts of capacity for its system.

NEW PROJECT

Power and energy from the Narrows Dam project located on the Little Missouri River in southwestern Arkansas became available to Southwestern Power Administration. The project is designed for three main generating units, each with a name-plate rating of 8,500 kilowatts. One unit was placed in operation on May 27, 1950; and the second unit began producing testing power and energy on June 20, 1950. Installation of the third unit is not contemplated in the near future. Average annual energy from the new project is estimated at 27,402,000 kilowatt-hours. With this new project, the Administration was able to meet an emergency for the Southwestern Gas & Electric Co. in June, when a boiler failed at one of the company's main steam plants, by furnishing power and energy to the company under a temporary arrangement.

ENERGY PRODUCTION

Net generation during the fiscal year from the three projects was as follows:

	Kilowatt hours
Denison	162, 079, 000
Norfork	251, 954, 500
Narrows	3, 058, 270

ENERGY DELIVERIES

Energy sales by the Southwestern Power Administration during the fiscal year 1950 amounted to $2,036,940.44. Electric power and energy generated by the hydroelectric facilities under the marketing jurisdiction of Southwestern Power Administration were sold to eight rural electric cooperatives, one municipality, and four private utility companies. Due to the lack of transmission facilities, a certain amoun of surplus power and energy from the Norfork Dam project, Denison Dam project, and Narrows Dam project was sold to private utilit companies under temporary arrangements.

Sales to municipalities and rural electric cooperatives amounted t $135,742.48, and to private utility companies $1,901,197.96.

CONTRACTS

Several new contracts were executed with rural electric cooperatives, generation and transmission cooperatives, and municipalities under which service will start as soon as interconnection facilities ca be obtained.

Continued efforts were made during the year to reach an agreemen with the two Oklahoma private utilities for integration and interconnection of facilities. It is anticipated that a contract will be executed early in fiscal year 1951, which will eliminate the construction of transmission facilities estimated to cost approximatel $6,000,000.[1]

SPA SYSTEM

At the end of fiscal year 1950 approximately 505 miles of high-voltage lines and one substation were being maintained by Southwestern Power Administration. Construction work contracted under the 1947 and 1948 appropriations was completed. These lines consisted of 259 miles of 154-kilovolt, 113 miles of 132-kilovolt, and 133 miles of 66-kilovolt transmission lines.

Under authorizations granted by the Congress, contracts were let under the 1950 appropriations for construction of 196 miles of 154-kilovolt lines, 70 miles of 132-kilovolt lines, two switching stations, and two substations. This construction will be undertaken in fiscal year 1951.

Muskogee, Okla., being the city nearest the geographical center of the main transmission line running from Denison Tex., to Norfork, Ark., was chosen as the location of the field operations center. Maintenance depots, with the necessary trained personnel, were located at Denison, Tex.; Muskogee, Okla.; Clarksville, Ark.; and West Plains, Mo. Patrol crews were stationed at Holdenville, Okla.; Van Buren, Ark.; and Marshall, Ark.

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[1] The Oklahoma contract was signed July 13, 1950, and full information on it will be given in next year's annual report.

Bureau of Mines

James Boyd, *Director*

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FOREWORD

ON JULY 1, 1950, the Bureau of Mines passed its fortieth birthday. The four decades since the Bureau was created in 1910 were marked by achievements that have earned world-wide recognition in the fields specified by the organic act: Mining and preparation of minerals; conservation of mineral resources; and advancement of health and safety in the mineral industries. Not only have the Bureau's investigations touched widely varying phases of the discovery, extraction, and treatment of minerals and mineral fuels, but the efforts to increase safety in mines are yielding heartening returns in improved accident and fatality rates.

Plans for the near future include projects that, if successful, would establish additional reserves of strategic minerals and augment the military and economic strength of the United States.

Early in its career the Bureau cooperated with the National Radium Institute in studies and plant operation that freed this country of dependence upon imports of radium, largely extracted from ores mined in this country but sent abroad for processing because we lacked the necessary knowledge. Techniques developed not only cut the cost of radium for the treatment of cancer to less than $40,000 a gram, compared with $100,000 to $120,000 a gram being paid for imported radium, but it also made feasible the use of much ore previously discarded as too lean.

Early studies, involving the location of ore deposits and the development of methods of mining and treating them, were largely responsible for the development of the domestic molybdenum-mining industry, which now leads the world; other Bureau studies helped pave the way for this country's self-sufficiency in potash.

These investigations were discontinued long since, in accordance with the Bureau's established policy of turning to other problems when it has carried its work to the point where industry is able and willing to assume the burden. This policy insures that the Bureau's scientific and technologic research will complement rather than duplicate that done by other public and private agencies. Much of the Bureau's program is carried on in cooperation with other Federal and State agencies, universities and private research foundations, and industry itself. This cooperation adds to their effectiveness.

The analysis of coals from most of the important fields in the country, primarily to guide Government procurement officials but also to assist all purchasers of solid fuel, has been an important Bureau undertaking from the beginning. Closely allied to this work have been studies of the combustion of coal that were instrumental in reducing the quantity of fuel required for producing a kilowatt-hour of electricity from about 3.2 pounds in 1929 to an average of 1.25 pounds in 1949. In cooperation with the electric power industry the Bureau developed the first successful generating plant to burn powdered coal—an improvement in the generation of power now in common use.

Other coal research has covered mining methods, with a view to helping the industry obtain maximum recovery, and methods of cleaning and otherwise preparing coal for market. In recent years the Bureau has given special attention to determining the coking properties of American coals. Its studies have shown that proper preparation, including blending with better coals in some instances, makes it possible to produce metallurgical coke from many coals not commonly used for the purpose.

The Bureau's scientific and technologic work on the extraction and refining of petroleum early won it the title "father of petroleum engineering," and the industry still regards its reports and publications as the "last word" in this field. During World War II the discovery by the Bureau that certain American crude oils previously considered unsuitable could be used for producing aviation gasoline played an important part in winning the Battle of Britain.

Because of their importance to mining and quarrying, whether viewed from the standpoint of efficiency, economy, or safety, the Bureau has devoted much study to explosives. It first introduced liquid oxygen explosives, known as LOX, in this country. It developed standards, issued as schedules, for testing the suitability of various explosives for safe use in coal mines, and those that meet these strict requirements are designated "permissible." Over the years it has conducted fundamental research on the nature and propagation of flame and on the basic physics of breaking rock by blasting—studies still in progress. It is constantly seeking to discover safer and more effective methods of blasting. During the two World Wars the Bureau licensed the sale and use of industrial explosives and conducted confidential tests for the armed services.

Closely allied with the work on explosives has been that on toxic and flammable gases and on mine ventilation. What is now the Army Chemical Corps was a development of these Bureau studies during World War I. Early in 1917 the Bureau turned its attention to the war gases and ways of protecting American troops against them. Later in the year this work was expanded with the aid of funds allocated by the War Department; and in 1918, by Executive order of the President, it was transferred to the Army. After the war Bureau research resulted in the development of highly efficient masks and respirators for protection against industrial gases.

Bureau of Mines research on ventilation methods and on the occurrence of carbon monoxide in automobile exhaust gases was utilized for the benefit of millions of persons having no connection with the mineral industries when it furnished the basis for the successful ventilation of the Holland Tunnel between New York City and New Jersey. This was the first long tunnel built for handling automobile traffic, and the method used for ventilating it has since been applied in a number of other tunnels in this country and abroad.

To the general public the Bureau's best-known activity is its participation in rescue and recovery work after mine disasters, an activity for which there has been less need recently than in earlier years. When the Bureau was established in 1910, after a series of coal-mine explosions taking thousands of lives, very little was known about the causes and prevention of such disasters. A new era in coal-mine safety dawned when the Bureau, at its experimental coal mine at Bruceton, Pa., proved for the first time that bituminous-coal dust will not only enter into and intensify a gas explosion but will itself explode and propagate an explosion in the absence of gas and that rock dusting will render it nonexplosive. Other safety advances in which the Bureau has assisted include the growing use of electric cap instead of open-flame lamps; the introduction in many mines of permissible explosives, which burn with a shorter and less hot flame and so are less likely to ignite gas or coal dust, to replace black blasting powder and dynamite; and the development of standards for testing electrical equipment to determine its suitability for safe use in coal mines.

It is interesting to compare the coal-mine fatality record of 1910, when 2,821 miners lost their lives and the death rate was 2.02 per million man-hours of exposure, with that of 1949, when accidental deaths of coal miners totaled 593 and the death rate per million man-hours was 0.96. It is also a source of satisfaction that 1949 was the first full calendar year in the statistical history of American coal mining to pass without a major disaster—defined as one causing five or more fatalities—and that as this report was written (in mid-August of 1950) there had not been a major coal-mine disaster since November 4, 1948.

Satisfaction over these records is tempered, however, by the knowledge that conditions such as have caused great disasters still exist in some coal mines. Nor is it possible to be complacent over the death of 593 men a year in a single industry, even though that figure represents notable safety progress. The problem still demands unremitting effort. The Bureau proposes to continue its attack by the threefold approach that has proved effective in the past: (1) Research and investigations to identify hazards and find ways of counteracting them, (2) education and training to spread the knowledge gained throughout the industry, and (3) inspections to learn the specific hazards present in individual coal mines and provide a factual basis for specific corrective recommendations.

Throughout its existence the Bureau has made the results of its work available promptly by means of its own publications by papers presented at scientific and technical meetings, by contributions to the trade and technical press, and by classes for workmen and supervisors in the mineral and allied industries.

During the Bureau's fortieth year its organization was streamlined to enable it to meet the mineral needs of the Nation more effectively. The number of operating divisions in the Washington, D. C., headquarters was reduced from five—Mining, Metallurgical, Fuels and Explosives, Health and Safety, and Economics and Statistics—to three—Minerals, Fuels and Explosives, and Health and Safety—corresponding to the three major commodity groups with which the Bureau deals. (For organizational purposes, health and safety is treated as a commodity.) In this reorganization the gathering and compilation of economic and statistical data, formerly conducted as a separate activity, were integrated with the Bureau's scientific, technologic, and educational work in the various commodity fields. In addition, the Director's staff was strengthened by the addition of a chief mining engineer, a chief metallurgist, a chief economist, and a chief of air- and stream-pollution research.

To bring the Bureau closer to the industries it serves and to free the top-ranking scientists and technologists on the Washington staff from a welter of administrative and fiscal details, which had left them less and less time to concentrate on coordinating and planning research and educational projects, the Bureau's field activities were divided among eight regions covering the continental United States and Alaska and a ninth, known as the foreign minerals region, to deal with matters of concern to the Bureau in the rest of the world. All personnel, fiscal, and administrative authority the delegation of which is not prohibited by statute or by regulations of higher administrative authority has been assigned to the regional directors.

The new regional organization, still under way, makes the Washington office in effect a GHQ, where broad phases of the Bureau's scientific, technologic, and educational work are planned and coordiited, priorities are assigned to projects, and the stations and labora-ries where various research projects are to be undertaken are etermined. Headquarters also maintains liaison with other execu-ve agencies and with the Congress. Direct communication is main-ined between top-ranking scientists and technologists at headquarters nd their colleagues in the regions. Provision has been made for l suggestions for improving the Bureau's services and for desirable esearch projects to reach the Director at Washington, accompanied y the regional director's approval or his reasons for disapproval.

The regions, the designation of each, and the territory each covers re: Region I, Alaska; region II, the Northwest, Washington, Oregon, daho, and Montana; region III, the Southwest, California and evada; region IV, the Rocky Mountains, Wyoming, Utah, Colorado, rizona, and New Mexico; region V, the North Central, North Dakota, outh Dakota, Nebraska, Minnesota, Iowa, Wisconsin, and Michigan; egion VI, the South Central, Kansas, Missouri, Oklahoma, Arkansas, ouisiana, and Texas; region VII, the Southeast, south from the orth Carolina-Tennessee northern borders to Florida and west to he Mississippi River; and region VIII, the Northeast, from the west oundary of Illinois to Maine and from the Great Lakes to the Vir-inia-Kentucky southern borders, also including Louisiana, Mo., where he Bureau's coal-to-oil demonstration plants are situated.

During the fiscal year, while being reorganized to increase the ffectiveness of its work, the Bureau continued its research and ducational programs. Major factors shaping its activities were he depletion of mineral resources as a result of two great wars, the ncreasing demands of the Nation's expanding economy for minerals nd mineral fuels, and the requirements of national security imposed y the uncertain international situation. Throughout the year the ureau keyed its activities closely to the needs of the National Defense stablishment, the National Security Resources Board, the Atomic En-rgy Commission, and other agencies directly concerned with military reparedness. Efforts to expand United States mineral resources by iscovering new deposits of strategic and critical minerals, by devel-ping improved methods that will make it possible to obtain more of he useful content of known deposits, and by devising ways of using lentiful materials in place of scarce ones were intensified.

The Bureau devoted much attention to the raw-material needs of he steel industry, including methods of increasing domestic supplies f manganese, chromite, and vanadium. In addition to exploratory, evelopment, and metallurgical studies of domestic reserves of low-grade manganese ores, the Bureau cooperated with the Iron and Steel nstitute in quest of feasible methods of recovering manganese from pen-hearth furnace slags, a potential source of the equivalent of

900,000 tons of imported ore a year. Another problem, toward whose solution progress was made, is the utilization of the Nation's vast deposits of iron ores of lower grade than those now used. Studies of these and kindred problems, the urgency of which increases yearly, are being continued.

Other pressing investigations concerned with metals and nonmetallic minerals, which the Bureau pushed during the year, were the low-cost recovery of lead and zinc from oxidized ores, the improvement of techniques for recovering and refining nonferrous metals from scrap, the utilization of the Nation's large reserves of siliceous bauxite, and the production of synthetic mica and synthetic asbestos.

A high light of the year's work on mineral fuels was completion of the study in the first counties in the Nation-wide survey of domestic reserves of coking coal. Besides inventorying the Nation's reserves of this important commodity, the Bureau is striving to expand them by developing methods of upgrading the poorer coking coals and by utilizing them in blends with better ones. Other work on fuels included the completion of the Louisiana, Mo., demonstration plants, where liquid fuels are being produced synthetically from coal; further reduction of the costs of mining and retorting oil shale; and advances in refining shale oil. At Gorgas, Ala., the second field-scale experiment in the underground gasification of coal, conducted in cooperation with the Alabama Power Co., pointed to the possibility of extending the Nation's coal resources by utilizing in this way seams too thin for mining. Meanwhile, further attention was given to the problems of drying, burning, and gasifying subbituminous coal and lignite, low-rank coals of which the United States has enormous reserves.

Petroleum research conducted during the year expanded the Nation's oil reserves by making it possible to extract a greater proportion of the oil in the ground both by secondary recovery methods applied to old fields and by more efficient primary recovery methods for new ones.

Intensifying its study of the air-pollution problems, to which attention had been forcibly called by the Donora, Pa., smog disaster of October 1948, the Bureau provided the chairman and cooperated with other Government agencies in laying the groundwork for and conducting the First United States Technical Conference on Air Pollution. Authorized by the President in December 1949 and meeting at Washington in May 1950, the Conference brought together for 3 days of discussion scientific and technical representatives from universities, industry, Federal, State, and local governments, and three foreign countries.

In respect to health and safety the Bureau completed the eighth full year of Federal inspection of coal mines under the Federal Coal-Mine Inspection Act of 1941. During this period the trend of coal-mine fatalities, which had been upward during the preceding 9 years, has been consistently downward, focusing the attention of all concerned upon the need for making coal mines in the United States safer places in which to work. Other Bureau activities that affected coal-mine fatality and injury rates were training courses in first-aid and mine rescue procedures, as well as special coal-mine accident-prevention courses for supervisors and miners. Similar courses were given in other branches of the mineral industries.

Without neglecting studies of the causes and prevention of coal-mine explosions and other accidents, the Bureau continued its intensive study of ways of preventing accidents from falls of rock and coal—the industry's No. 1 hazard—and prepared for a similar attack upon prevention of haulage accidents. Experiments on roof bolting to supplement or supplant conventional roof-support methods, which the Bureau introduced to the coal industry in 1947, were continued and expanded to include more fundamental research on the behavior of mine roof under loading. The contemplated concentration upon the problem presented by haulage hazards was scheduled to get under way during the coming fiscal year.

A high light of the year's health and safety program was inauguration of a policy of investigating all fatal coal-mine accidents with a view to determining more effective ways of preventing them. In the past the Bureau had investigated major disasters but had seldom been in a position to study accidents causing only one or two deaths. Such accidents, while apparently minor, year after year cause the bulk of coal-mine fatalities.

To make the results of its studies in all branches of its field available to the industries, the Bureau published them as rapidly as feasible. The number of copies of each report was held down as much as possible in the interest of economy.

The foregoing discussion covers some of the major activities of the Bureau during the past fiscal year. A more detailed summary of all phases of the Bureau's work is given in the sections that follow.

MINERAL DEVELOPMENT

Pressure of the cold war, the outbreak of fighting in Korea in the closing days of the fiscal year, and the military importance of minerals have had a marked influence on the work of the Bureau of Mines during the 12 months ended June 30, 1950. Without neglecting long-range planning for mineral conservation and development, essential alike to the Nation's economic strength and its military security, the Bureau tied its activities even more closely to the needs of the Department of Defense, the National Security Resources Board, the Atomic Energy Commission, and other agencies directly concerned with military preparedness.

The Bureau's fact-finding and advisory services grew in number, scope, and urgency. The stockpiling program of the Munitions Board, on many of whose active committees Bureau staff members serve, continued to require a large share of these services. In addition, special technical investigations were made for the Federal Supply Service in connection with the procurement of mineral commodities, the beneficiation of low-grade stocks, and the improvement of stockpile storage procedures.

Toward the close of the year major investigations of the world situation regarding a number of critical metals and minerals were begun for the National Security Resources Board. Reports will be prepared on the status of mining and smelting operations, secondary recovery, stocks, foreign trade, plants, and related phases of these industries. Congressional committees were supplied information requested upon iron ore, managanese, chromite, and other commodities. The Bureau also furnished representatives for the Department on interdepartmental committees assisting the Office of International Trade with regard to licensing the export of strategic commodities. Bureau staff members likewise served on the United States delegation to the International Tin Study Group at The Hague in October 1949 and at Paris in March 1950.

A new experiment station at Juneau, Alaska, for which a construction contract had been awarded in June 1949, was completed ahead of schedule and occupied in January 1950.

As in previous years, other activities included fundamental and applied research, investigations of mineral resources, and the technical and economic appraisal of problems of the mineral industries.

Ferrous metals.—Assuring an adequate emergency supply of manganese, essential for steel making, received close attention during the year. The Interdepartmental Manganese Coordinating Committee was formed to focus the attention of interested Government agencies and private industry upon the Nation's manganese problem. Intensive investigations of major domestic manganese deposits in Maine, Minnesota, Arkansas, Montana, and Arizona increased factual knowledge of domestic reserves. Development of the large deposit at Artillery Peak, Ariz., was begun. Bureau metallurgists studied ways of utilizing low-grade domestic ores for the production of ferromanganese, electrolytic manganese, and battery-grade manganese.

In cooperation with the American Iron & Steel Institute, the Bureau is devoting research to development of a practicable method of reclaiming the manganese, equivalent to 900,000 tons of imported ore annually, in the manganese-rich slag from open-hearth steel furnaces.

Experimental mining of and metallurgical research on the low-grade chromite ores of Montana were continued. Certain tests indicated that these ores, forming a large but submarginal reserve, may be an acceptable substitute for imported chemical-grade chromite. Other research led to the development of a new method of smelting whereby a low-carbon chromium-nickel-iron alloy can be produced directly from northwestern chrome-nickel-iron ores. In cooperation with a major chromium and ferrochromium producer, electrolytic chromium pilot-plant operations continued through the year.

Future iron-ore requirements and sources of supply received much study, and research was continued on the utilization of domestic ores of lower grade or poorer quality than present furnace feeds. An ore-reserve study of the Birmingham iron district in Alabama was begun. Continuing research pointed to flotation and gravity concentration as the most promising ore-dressing methods. The nodulizing and pelletizing of fine iron-ore concentrates to permit reduction in the blast furnace comprised another research project.

A method has been devised for recovering vanadium and other metals that are concentrated in the ferrophosphorus when phosphate rock from some of the lower-grade deposits of the West is smelted to produce phosphorus and phosphoric acid. Meanwhile a small experimental mining operation has been carried on to learn the best methods and probable cost of mining the high-vanadium formation selectively.

Nonferrous metals.—Demand for nonferrous metals continued to grow, emphasizing the need for conservation and the development of domestic resources. Marginal and submarginal deposits of copper, lead, and zinc were investigated in the States and in Alaska. "Atlases" designed to preserve and make readily accessible all available factual information on the ore reserves in certain large mining districts were prepared in cooperation with mining companies, property owners, and State and Federal agencies. Metallurgical tests to devise low-cost means of recovering lead and zinc from oxidized ores were continued, partly in cooperation with industry. As another conservational measure, improved techniques are being developed for recovering and refining nonferrous metals from scrap and for recovering metals from drosses and other metallurgical wastes.

With funds provided by the Atomic Energy Commission, the Bureau has been studying radioactive minerals in various placer deposits in California, Idaho, and Nevada for that agency. This investigation has resulted in a series of reports evaluating the economic and strategic importance of each such deposit, including recommendations for methods of mining and recovery of the "black sands" and radioactive minerals. Because of the newness of this subject, the work has raised many problems of exploration methods and equipment, sampling techniques, mineral identification, and analysis. Research and experimentation in the field and at the Bureau's Mount Weather, Va., laboratories have contributed much to the solution of these problems.

Under an arrangement with the Atomic Energy Commission, the Bureau tested and evaluated about 8,000 samples of ore believed to contain uranium. For the Atomic Energy Commission, too, research was conducted on the concentration and extraction of uranium from ores of the Colorado Plateau area.

The Bureau identified bastnasite, a fluocarbonate of cerium and other rare earths, in a large deposit in the Clark Mountain district, San Bernardino County, Calif. Concentration and extraction tests are being made on this ore because of its importance as a substitute for monazite sands.

A pilot plant at Boulder City, Nev., produced titanium metal at the rate of 200 pounds a week. Much of this metal is made available to industry for private research, as commercial facilities cannot meet all needs. The rest is used by the Bureau in continuing experiments, especially on fabrication methods. An outstanding achievement was the successful fabrication of several welded titanium structures, including a mortar base and a Diesel-engine muffler.

A notable development in the study of zirconium alloys for high-temperature use was the discovery that small amounts of tantalum or columbium added to zirconium make it corrosion-resistant to water at 600° F.

Recent experiments have suggested the possibility of lower-cost production of magnesium from dolomite. Using helium at atmospheric pressure to prevent reoxidation of magnesium vapor may eliminate high-vacuum operation and permit a continuous instead of a batch process. A general investigation is being conducted on the development of new and improved magnesium alloys as substitutes for scarce metals.

Research in quest of a practicable method of treating siliceous bauxites to permit their use in aluminum manufacture is being continued. Domestic reserves of such ores are large.

Nonmetallic minerals.—Ceramic research is in progress on the production of superduty refractories from domestic raw materials. An investigation carried on throughout the year disclosed a large tonnage of kyanite ore suitable for milling in a Buckingham County, Va., deposit. The Bureau also is testing refractory raw materials purchased for stockpiling.

Pegmatite deposits in Colorado and South Dakota were investigated as potential sources of mica, beryl, and other associated minerals. Field and laboratory studies aimed at fuller recovery and utilization of the minerals of these complex deposits are being continued.

As part of the Missouri Basin development program, the Bureau surveyed the mineral resources, largely nonmetallics, of Nebraska and that part of Kansas lying within the basin. It also drilled sodium sulfate lake deposits in North Dakota. In addition, mine and mineral surveys of several Montana mining counties were completed.

As part of a continuing program designed to lessen, if possible, the cost of construction in Alaska, building materials along the Alaska Railroad were investigated.

The unprecedented demand for structural materials has led the Bureau to give a great deal of attention to lightweight aggregates and mineral insulators. Fundamental research and pilot-plant work have demonstrated the feasibility of obtaining such products from various natural deposits as well as from industrial wastes, thus contributing to the increased commercial production of lightweight aggregates, plasters, and heat-insulating materials.

In the interest of national security the Bureau continued extensive investigations on the possibility of producing synthetically certain industrial minerals of which this country lacks adequate deposits. Progress was made in the production of synthetic mica, and studies were made of conditions favoring the formation of strategic grades. It appears that the physical properties of the synthetic product will equal or surpass those of natural mica. Work is underway on the manufacture of synthetic asbestos from various types of melts. In this connection, conditions favoring the growth of the desired long, slender, fibrous crystals are being determined. The Bureau is also developing methods for better utilization of short-fiber and off-grade natural chrysotile asbestos.

Miscellaneous mineral research.—Blasting is not only one of the chief cost items in most mining operations but is the subject of several current engineering research projects of the Bureau. Among these are blasting methods in oil shale, oil-well shooting, and dam-foundation excavation and tunnel excavation (for the Corps of Engineers). Because the mechanics of the generation and propagation of elastic waves in rock by the use of explosives is a problem fundamental to such inquiries, it is the subject of special studies. A new and larger instrumentation truck was put into service during the year. As a result, records from as many as eight stations can be picked up simultaneously and recorded photographically, permitting more rapid and accurate analysis of the behavior of strain waves in rock after an explosion. Records have been obtained in sandstone, chalk, and shale, and during the coming year similar tests are to be made in other kinds of rock.

Adaptation of underground development blasting practices to the use of millisecond-delay electric detonators was carried forward in the experimental hard-rock mine at Mount Weather near Bluemont, Va. Results from numerous drift and raise rounds pointed to the possibility of substantial savings in drilling and explosives costs, together with improved fragmentation. Preliminary data have been published.

Continuing past arrangements, the Bureau has provided specialized microseismic equipment and occasional observation and consultation in connection with the removal of pillars at an iron-ore mine in Michigan. Large tonnages of ore are being extracted safely. The operating company is now using the microseismic technique for studying ground movement, especially the subsidence of overburden, at two other mines.

Experimental diamond-drill bits cast in the Mount Weather, Va., laboratory were tested in the experimental mine there and on a field drilling project with promising results. Instead of being set at random, as in standard commercial bits, the stones were placed with their crystals carefully oriented to take advantage of the so-called "hard vector." As the tests showed the possibility of notable economy, this investigation is being continued in cooperation with diamond-drill contractors and manufacturers.

The Bureau completed a 2-year project for the Corps of Engineers research and development laboratories with the transmittal of a report that will form the basis for a military text on quarry equipment and operation.

Several hundred examinations of mineral deposits were made in the continental United States and in Alaska. Systematic, county-by-county surveys of the mineral resources of several States were carried forward, in a few instances to completion. Considerable progress was made on a survey of mineral resources around Skagway, Alaska, where a large Canadian-American hydroelectric power development is under construction.

Completion of three more core-storage warehouses during the year brought facilities for the storage of cores from governmental and private mineral exploration projects within a convenient distance of nearly every mining section in the country.

Research continued to determine and correlate thermodynamic data on metals and metallic compounds used in metallurgical processes.

Similar data previously published by the Bureau are known and used by metallurgists throughout the world. A new compilation of entropy data also was made available.

FUELS AND EXPLOSIVES

The Bureau of Mines program of fuel research and development last year concentrated upon increasing efficiency and improving quality in the fuel industries. With continued emphasis upon the promotion of safety and conservation in order that the Nation might derive the greatest good from its fuel resources.

Designed to augment dwindling reserves of coking coal, the Bureau's program of estimating known minable reserves of such coals was prosecuted vigorously, as were studies of the washing and blending characteristics of lower-grade coals not now suitable for making metallurgical coke. Much attention was given to the problems of drying, burning, and gasifying the enormous reserves of lower-rank coals—subbituminous coal and lignite—to insure the most effective utilization of domestic resources. Laboratory research, coupled with pilot- and demonstration-plant operations, pointed the way toward the future economic and technologic feasibility of producing synthetic liquid fuels from coal and oil shale on a commercial scale. Petroleum research aided materially in increasing total recovery from present fields, with a consequent increment in our total petroleum reserves. Demands for helium from all consumers increased during the year, and the Bureau stepped up production of this unusual gas accordingly.

COAL AND COAL PRODUCTS

Coal mining and investigations.—Seeking to improve mechanization and mining methods in the anthracite fields of Pennsylvania, the Bureau successfully tested a machine for packing waste material into underground chambers to support the roof, developed mechanical methods of mining thick horizontal beds to recover millions of tons of anthracite now left underground, and demonstrated the suitability of lightweight cutting and shearing machines for mining thin, steeply pitching beds. Studies of methods of pillar removal in mechanized mines were continued in bituminous mines in West Virginia and Kentucky.

As development of additional reserves of coal in Alaska was extended, Bureau core drilling in the Matanuska field indicated existence of a minable reserve sufficient to warrant opening a mine. Diamond-drilling investigations in Maryland disclosed recoverable reserves of more than 450,000,000 tons of coking coal, an appreciable addition to our depleted reserves of coal suitable for metallurgical coke. In a study of coking-coal reserves data on the reserves of Cambria and Indiana Counties, Pa., and Pike County, Ky., were brought together. Thirty-one additional counties in Pennsylvania, Kentucky, West Virginia, and Virginia were surveyed.

Cooperating in the development of the resources of foreign countries, Bureau engineers investigated Greek lignite deposits, made recommendations, and assisted in core drilling and mining operations.

Coal preparation.—To enlarge supplies of coking coal, studies of the preparation characteristics of coals from Cambria County, Pa., and the Pocahontas No. 6 bed in West Virginia showed that most of the coals tested meet present metallurgical requirements. The kerosine-flotation process, developed by Bureau engineers, was installed in a second commercial washery in Alabama. Successful operation of the cyclone washer with coals varying widely in impurities was achieved without material effect on quality of the product. Treatment of Washington coals by chemical leaching processes yielded a product suitable for use as electrode carbon in the metallurgical industry.

Coking, gasification, drying, and combustion studies.—Of the many eastern Appalachian coals tested for carbonizing properties, several proved satisfactory for more extensive use in satisfying demands for coking coal. Similar tests were conducted on coals from British Columbia and Alaska to determine their suitability for use in far West steel plants. Research on the complete gasification of bituminous coal in the Lurgi pressure generator demonstrated that gas could be made successfully at rates more than double those attained in Europe with brown coal and lignite. Seeking to utilize the Nation's vast reserves of lignite, the Bureau operated its annular gasification retort at Grand Forks, N. Dak., to obtain additional data on the capacity of this type of equipment and demonstrated that the life of this retort is sufficient to make the process appear feasible where low-priced natural gas or oil is not available.

In an endeavor to utilize Texas lignites for generating power, a new program of drying and gasifying them was undertaken in cooperation with a Texas power company. A large, gas-fired, utility, power-station boiler was tested to compare its performance with that of pulverized-coal-fired boilers previously tested.

Research facilities.—The first unit of the anthracite research laboratory at Schuylkill Haven, Pa., was completed and occupied. Architectural drawings and specifications for the additional wing, which will bring the laboratory up to the size originally authorized, were completed and approved. Completion of this wing is expected during 1951.

Work was begun on the lignite research laboratory at Grand Forks, N. Dak., and completion of the building is expected in late 1950.

Services to the Government.—Approximately 23,000 samples of coal and related materials were analyzed for the Bureau and other Government agencies. Coal analyses and related data on Iowa coals were published in another of the Bureau's series of papers on analyses of coal by States. In the coal-sampling service required for Federal coal purchases and general research work samples were taken at 480 mines, and special training in coal sampling was given plant personnel at 5 Federal installations.

Boiler-plant operating costs were compared for the use of oil, gas, and coal, and the type of fuel-burning equipment was recommended for nine new Veterans' Administration hospitals. Boiler-plant surveys were made for various agencies, with substantial savings—in one instance $30,000 and in another $52,000—in the cost of new equipment. Services on 160 special fuel-burning problems were given 36 different Federal agencies.

In serving Federal boiler plants more than 9,300 samples of boiler water were analyzed and recommendations made, and numerous special boiler-water problems were solved. Typical of the results is the experience of the Albuquerque, N. Mex., Indian school, where tests showed an annual fuel saving of $13,700. Research work on the fundamental cause of corrosion of boiler equipment was continued. Five hundred large industrial plants reported good success with caustic embrittlement prevention methods developed by Bureau of Mines research.

The pronounced drop in coal production stimulated widespread interest in the position of coal in its relation to the national health, economy, and security, including the effect on employment and economic conditions in the coal and related industries. To meet unusually heavy requests for detailed information, the statistical and economic studies of the Bureau on production, distribution, consumption, stocks, and use of bituminous coal, anthracite, lignite, coke, and coal chemicals were expanded so that the many problems involved could be analyzed.

Details regarding the economic aspects of the various energy sources were maintained on a current basis for continuing appraisals of the national energy supply. For correlation with these energy studies and for guidance in appraising emergency fuel requirements, plans were made to study coal-distribution patterns and methods for increased efficiency in coal production and utilization. Bureau representatives, both as members and in preparing basic data, took an active part in the work of a number of important committees concerned with peacetime and emergency availability of coal and coke. The Bureau also cooperated closely with committees and members of the National

Bituminous Coal Advisory Council in reappraising the Nation's coal reserves and devising methods of increasing the rate of recovery and conservation of domestic coal resources.

Papers by Bureau coal specialists were presented at the International Conference on Coal Preparation in Paris during June 1950.

Synthetic Liquid Fuels

In the Bureau's synthetic liquid fuels research and development program advances were made toward the production of competitive products from oil shale and coal, process improvements and further reductions in the cost of mining oil shale leading the way.

Oil from coal.—At Louisiana, Mo., major activities in the new coal-to-oil demonstration plants shifted from design and construction to completion of equipment installations, testing, and initial operations.

In the 200- and 300-barrel-a-day coal-hydrogenation plant break-in and initial operating runs were completed successfully in the liquid-phase section, where the coal is liquefied, and in the vapor-phase section, where the liquefied coal is converted to gasoline and other products.

Construction of the final units of the 80- to 100-barrel-a-day gas-synthesis plant was completed. Two units, the oxygen producer and the coal gasifier, made trial runs while construction proceeded on the gas purification and synthesis units.

Many engineering and cost studies for plants of commercial scale were completed during the year, and an investigation was undertaken on the chemical byproducts of synthetic fuels produced from coal and oil shale, including benzene, phenol, and other chemicals now relatively scarce.

At Bruceton, Pa., the work of the coal-to-oil laboratories and pilot plants centered on the development of new and improved processes for the synthesis of liquid fuels from the gas produced from coal and by the direct hydrogenation of coal. Two synthesis pilot plants were operated, as were liquid- and vapor-phase coal-hydrogenation pilot plants. Research disclosed a direct method for converting an alcohol into the next higher alcohol (containing one more carbon atom), a discovery of marked commercial importance. Laboratory tests to discover new, more readily available catalysts as reactive as tin in coal hydrogenation have shown that impregnating coal with such materials as ferrous sulfate, nickel chloride, and ammonium molybdate is highly effective.

At Gorgas, Ala., the Bureau of Mines and the Alabama Power Co. made significant progress in their second field-scale experiment in the underground gasification of coal. No difficulty was encountered in maintaining combustion, and more than 3,000 tons of coal were burned without finding a limit to the quantity that can be consumed from an area surrounding a given initial entry.

In the synthesis-gas-production laboratories at Morgantown, W. Va., the problem of producing cheaply the carbon monoxide and hydrogen required in synthetic-fuel manufacture was under attack from another quarter. A small pilot plant successfully gasified virtually any kind of coal, regardless of ash or sulfur content. A gas-purification pilot plant was completed and operated.

Oil from oil shale.—Near Rifle, Colo., low-cost methods and equipment were developed for mining one of the world's greatest fuel deposits—the Green River oil-shale formation of Colorado, Utah, and Wyoming. In a public test run in the Bureau's completely mechanized experimental mine, 32,560 tons of shale was mined at a direct cost (excluding depreciation, general office expense, and overhead) of only 29 cents a ton. The average production rate, establishing a new high for underground operations, was 148 tons per man-shift of underground labor, or 116 tons per man-shift of total labor. Substantial progress was made in all phases of the mining research program, particularly in those problems associated with the drilling and blasting of oil shale.

In the nearby oil-shale demonstration plant research was centered on retorting and refining problems. Shale gasoline and Diesel fuel produced in the new refinery unit were burned with good performance in automobiles, buses, Diesel trucks, and other equipment.

Ten cooperative agreements with industry and educational institutions to supply oil shale, shale oil, and shale-oil products for experimental work were added to 25 already in effect.

At Laramie, Wyo., the Bureau studied the composition of oil shale and shale oil and developed new methods of processing and using these materials. Hydrogenation was found to be the most practicable known method of refining shale oil to reduce the sulfur and nitrogen content and yield good-quality fuels, and shale oil was found to contain large amounts of valuable chemicals.

PETROLEUM AND NATURAL GAS

With petroleum supply again adequate for present demands, the Bureau directed its petroleum research toward further increasing ultimate oil recoveries from known fields and toward the wiser and more effective use of the vast quantities of oil now produced.

Studies of water flooding as one method for recovering more oil were continued. A completed survey of all water-flood projects in north Texas and a detailed study of some in Kansas will guide operators in extending present projects and initiating new ones. Used successfully for several years in the Appalachian region, an intermittent method for flowing oil wells on gas-injection projects was introduced to the midcontinent area by the Bureau as another method of increasing production and reducing costs. A study of the Brennenman, W. Va., field disclosed that 350,000 additional barrels of oil will be recovered from secondary recovery operations.

Engineering studies of oil and gas fields in Pennsylvania, West Virginia, Oklahoma, Kansas, Texas, Colorado, Wyoming, Montana, and California were continued, and a study of the Nation's third largest gas field—the Carthage field in Texas—was concluded. Analyses of oil samples from fields producing the more volatile liquids disclosed that present estimates of total liquid reserves in such fields will have to be revised upward as much as 100 percent in some instances. Field tests showed operators of natural-gas wells how to make large savings through proper control of periodic blowing of wells to remove water. To effect sizable savings on costs arising from freezing and other problems, natural-gas pipeline companies installed still more water-vapor dew-point recorders developed by the Bureau.

A complete study of the thermodynamic properties of nine important normal paraffin hydrocarbons was completed. In cooperation with industry a broad program on the production, isolation, and purification of sulfur compounds gained momentum. To satisfy the ever-increasing demand for crude-oil analyses, the Bureau made more than 200 routine crude-oil assays on both domestic and foreign crude oils, and information on properties of asphalts from Rocky Mountain crude oils was compiled. Nitrogen contents of 153 domestic oils were determined and correlated with the geological origin and carbon residue of the oils. In cooperation with the American Petroleum Institute the Bureau published periodic surveys of the quality of commercial motor gasolines, aviation gasolines, and Diesel fuels.

Adequate fuel supplies in 1949 presented new problems in the competition for markets and emphasized the need for new types of factual information and expansion of old. Statistical measures of the regional movement of petroleum products by pipeline and rail were developed, as were data on offshore shipments of petroleum by the military services. More detailed information on petroleum was released to the public, and statistical procedures used for reporting operations on the Pacific coast were revised and improved.

Monthly publication of World Petroleum Statistics was begun, to provide information on crude-oil supply and demand and on production of the principal refined products by the countries of the world.

HELIUM

Helium production increased 17 percent to a total of 63,311,003 cubic feet, all from the Bureau's plant at Exell, Tex. This reflected an increase of 27 percent in demands for helium for commercial and medical use that totaled 20,030,992 cubic feet. Shipments to Federal agencies increased more than 30 percent. Revised helium regulations, amended to facilitate the sale of helium for commercial use, were approved by the President on December 3, 1949.

More than half of the total shipments for the year had a purity of 99.9 percent, supplied mainly for use in helium-shielded arc welding. Characteristics of additional oil and gas reservoirs were determined by the use of helium as a tracer gas, and research progressed on the liquefaction of helium and the use of helium in welding of metals and alloys.

EXPLOSIVES AND EXPLOSIONS RESEARCH AND TESTING

Explosives.—Seeking further reduction in the hazards associated with explosives, the Bureau conducted approximately 1,680 tests on permissible explosives, special explosives, and hazardous chemicals. The active list of permissible explosives decreased to 174 by the shift of 38 explosives to the inactive list and the addition of 15 to the active list. The quantity of explosives used in coal mines decreased approximately 28 percent under that in the previous year, but the ratio between the use of permissible explosives and black powder remained almost constant.

The study of simultaneous and short-delay multiple blasting of coal was extended to include a study of the vibrations of the mine roof during such blasting. Testing was continued on the safety characteristics of incombustible stemming devices, and research disclosed that a permissible explosive can ignite a preformed cloud of coal dust. The relationship between the fundamental characteristics of military and commercial types of explosives and the breakage produced in various types of rock was explored.

Gas and dust explosions.—The Bureau continued its program to eliminate dust-explosion hazards by determining the explosibility of approximately 75 dust samples. The relative effectiveness of various diaphragm materials for the relief of explosion pressures was evaluated, providing data that can minimize damage from dust explosions.

In an effort to achieve greater safety in industrial use of gases and vapors the ignition temperatures and limits of flammability in air for a number of industrially important compounds were found, as were the quantities of inert gases required to make several of the gases nonflammable. Relationships for rendering natural gas-air mixtures nonflammable at high pressures were worked out. To eliminate a critical industrial hazard, a method was developed for stabilizing acetylene gas by adding other flammable gases.

In the Bureau's research program on the ignition and propagation of flame certain phenomena of turbulent combustion not only were qualitatively explained but also were shown to be amenable to quantitative computations. Irregular propagation of flames under conditions supposedly conducive to regular propagation was discovered.

SAFETY AND HEALTH ACTIVITIES

The Bureau of Mines is the only Federal agency responsible for improving safety and health conditions in the mines and plants of the mineral industries. For four decades it has discharged this responsibility, one of its oldest, by (1) conducting research and investigations to obtain fundamental and specific knowledge of hazards encountered in the industries and ways of correcting them and by (2) providing education and training for workmen and officials so that they will be able to put the knowledge gained to practical use. To these two approaches a third was added in 1941—inspections, to identify the hazards existing in individual coal mines and provide a factual basis for corrective recommendations.

Investigations and tests.—The two principal hazards in coal mining are falls of roof and coal and haulage operations. Together, they have for years caused more than half the Nation's coal-mine fatalities. During the fiscal year the Bureau continued its intensive attack upon the problem of roof support and prepared for a similar study of coal-mine haulage methods and practices.

An outstanding contribution to the reduction in roof-fall injuries has been the introduction by the Bureau of roof bolts to supplement or supplant conventional timbering in coal mines. By the close of the fiscal year roof bolting had been adopted in 354 coal mines, where an estimated 37,260,000 square feet of mine roof was secured with approximately 2,170,000 bolts. Roof bolting also was applied in 19 noncoal mines, in which 255,380 bolts were used to secure 5,267,600 square feet of roof.

Research work on roof bolting was done both in the field and in the laboratory. In efforts to solve some of the technical problems involved in this rapidly spreading method of roof support tentative standards were established for torque to be applied in roof bolting. A centrifugal testing laboratory was established and equipped with a centrifuge of 2-foot working radius, capable of developing a field of 2,500 times gravity, for use in testing models of mine structures under body loading. In the field, meanwhile, a cooperative project was begun at the Dehue, W. Va., coal mine of the Youngstown Mines Corp., to determine the safest and most efficient method of roof bolting. Color photography of the inside of boreholes is being used experimentally in this work. Other field studies involve the use of the stratascope to determine strata separation, torqueometer readings to determine bolt tension, roof painting to determine efficiency in preventing the disintegration of mine roof, and the adoption of roof bolting where pillars are being extracted.

Plans were completed for establishing a special group to study haulage problems in a similar manner. Its first task will be to gather information on haulage practices in coal mines, make a thorough study of injuries charged to haulage, and publish the data gathered so that the industry may be better equipped to overcome haulage hazards.

Throughout the fiscal year the Bureau continued its efforts to increase electrical and mechanical safety in coal mines. These activities included (1) investigation of electrically operated machines and appliances to determine whether they are so constructed as to minimize gas- and dust-ignition hazards as well as the risk of electrical shock, (2) investigation of Diesel-engine-operated mine locomotives and equipment with respect to safety of operation in mines, and (3) research on the cause and prevention of accidents injuring men working with or around equipment.

This work consists mainly of inspections and tests to determine whether various new types of machines and appliances meet Bureau of Mines standards (issued as schedules) prescribing the safety features that should be built into equipment designed for use in gassy coal mines. Equipment must meet these standards before the Bureau will formally approve it as "permissible," indicating that under prescribed conditions it is safe for use in gassy mines. Approvals are granted under 10 different schedules.

Seventy-two formal approvals of equipment were granted during the fiscal year. This number indicates a continually increasing demand for permissible equipment, largely the result of Federal coal-mine inspections. Tests to determine flame-resisting qualities were made on 64 trailing cables. To permit changes in approved electrical equipment, 194 formal and 1,403 informal extensions of approval were granted under 10 different schedules.

Health.—The Bureau's efforts to improve health conditions in the mineral industries centered largely upon studies of atmospheric conditions in mines and plants. More than 17,000 gas and dust samples were analyzed during the year. They were collected in coal, metal, oil-shale, limestone, and potash mines; in tunnels under construction; in connection with investigative work for the military services; in connection with the investigation of accidents; and in various laboratory studies. Bureau engineers used the results of these analyses and examinations as a basis for recommendations to correct or prevent hazards from flammable or toxic gases or from harmful airborne dusts to improve mine ventilation and to determine progress in extinguishing sealed mine fires.

Eight new approvals and twenty-five extensions of approval were granted for respiratory protective devices during the year. Many consultations with representatives of manufacturers of respiratory devices were held to aid in developing equipment meeting the requirements of the Bureau of Mines approval system. Almost universal acceptance and requirement of Bureau-approved devices by industries, insurance companies, and governmental agencies attest the signficance of this work.

The Bureau also continued literature research and the compilation, coordination, and documentation of scientific information relating to industrial hygiene and preventive medicine in the mining and allied industries.

Accident analysis.—Demand for the Bureau's current reports on injury records of the mineral industries continued to increase with the growth of interest in accident prevention in mines and quarries. In addition to the regular injury analyses on an industry basis, the Bureau prepared many special analyses of injury data for use in planning and directing the safety-engineering and inspection work of Federal and State agencies, producers' associations, labor groups, and operating companies. A record total of 903 mineral plants enrolled in the safety competitions for 1949, which marked the twenty-fifth anniversary of these annual contests. Demand for data on the consumption and ingredients of industrial explosives also continued to grow.

Safety education.—Although the coal-mine inspection program of the Bureau has contributed largely to the downward trend in accident rates during the past 8 years, it can reach its peak effectiveness only if mine supervisors and miners know enough about modern concepts of coal-mine safety to recognize a hazardous condition or practice when they encounter it and to take the proper steps to correct it. The Bureau provides them with an opportunity to obtain this knowledge through coal-mine accident-prevention courses, one designed for supervisors and another for miners.

The popularity of these courses is shown by the number of persons who attend the classes voluntarily. Since the revised course for supervisors was first offered in March 1948, 8,707 mine officials have completed it, 5,330 of them during the fiscal year. It is estimated that about 50,000 supervisors are employed in and around United

States coal mines. The revised course for miners was introduced in January 1947, and 23,548 miners had completed it through the close of the fiscal year. The demand for this course is growing, but the number of classes conducted is limited by the number of coal-mine inspectors who can be spared for this work. The metal-mine accident-prevention course was given to 985 persons who completed it and to 243 who received some training during the fiscal year. The petroleum-gas course was completed by 145 persons and partly completed by 87.

During the fiscal year 32,734 employees of mining and allied industries were given first-aid and mine rescue training, bringing the total persons who have completed such courses since the establishment of the Bureau to 1,770,528. With the training of 226 instructors, more than 18,230 persons throughout the country have become qualified to teach the Bureau of Mines first-aid course. During the fiscal year 72 mines and plants were awarded certificates showing that all employees had been trained in first aid.

Coal-mine inspections.—The fiscal year 1950 was the eighth full year of Federal inspection of coal mines under authority of the Coal-Mine Inspection Act of 1941 (Public Law 49, 77th Cong.). While this period represents only a fifth of the Bureau's life, it is long enough to permit an evaluation of the effectiveness of this channel of approaching the problem of reducing the hazards of coal mining. As the chief purpose of the act is to reduce the number of coal-mine accidents, both absolutely and in relation to the number of man-hours worked, by calling the attention of miners and operators to hazardous conditions and practices, the trend of coal-mine injury rates provides a gage of the value of the work carried on under it.

The upward trend in coal-mine fatalities per million man-hours of exposure during the 9 years before the passage of the act was reversed in 1942 and has continued to decline steadily. The 1949 fatality rates of 0.85 per million man-hours of exposure for anthracite mines and 0.98 per million man-hours for bituminous-coal mines were the lowest ever attained by the industry. Nonfatal-injury rates also are declining. The rate of 75.18 nonfatal injuries per million man-hours of exposure in Pennsylvania anthracite mines achieved during 1949 set a new low. Perhaps the most significant attainment, from the viewpoint of the general public, is that at the time this report was written in August 1950 there had been no major coal-mine disaster—defined as one causing five or more deaths—since November 4, 1948. This is the longest disaster-free period in the statistical history of American coal mining.

These favorable records cannot rightfully be attributed to the sole efforts of any one group or agency. Coal-mine safety requires the wholehearted cooperation of operators, miners, and State and Federal agencies working together for a common end. However, it is generally recognized that Federal activities under the Coal-Mine Inspection Act have proved a powerful influence in focusing the attention of all concerned upon the importance of safety and health in mines.

Approximately 8,000 coal mines were operated more or less regularly during the fiscal year. The 250 Federal inspectors allotted visited 5,674 of them and made 8,183 inspections in all. This brought the number of inspections completed since the inception of the program to 33,615. An individual report on each coal-mine inspection is prepared. Besides recording all unsafe conditions and practices observed and making recommendations for correcting them, the inspector credits the mine with all safety improvements made since the previous inspections. Copies of each report are sent to the mine operator, the officials of the mine workers' union, the State mining agency, and the Joint Industry Safety Committee.

Although the records show a decline in coal-mine accidents, much remains to be done before injury rates in coal mining will be in line with those of other major industries. Lack of attention to imminent dangers is revealed by the fact that 41 percent of the Federal inspections made during the fiscal year disclosed serious hazards. Only 30 percent of the Federal inspectors' recommendations were followed during the year.

Aside from inspecting coal mines, the Bureau's principal activity under the Coal-Mine Inspection Act is to investigate all coal-mine fatalities. Made possible by a decrease in the number of fatal accidents and modest increases in the number of inspectors, these investigations were begun on February 10, 1950. Complete fatality reports are prepared for distribution to all persons who receive copies of the regular inspection reports. The information obtained is published from time to time. It should assist the industry in planning future accident-prevention programs.

Control of fires in inactive coal deposits.—Another relatively new activity of the Bureau in the field of safety and health is the control of fires in coal deposits not now being mined. This work was first undertaken in the fiscal year 1949, and considerable progress has been made already. Before that time the Bureau could only investigate such fires and make recommendations for controlling them, even though they have caused the loss of thousands of acres of valuable coal reserves, damaged or destroyed considerable surface property, and menaced the life and health of persons living nearby.

Since funds for combating such fires first became available, 17 have been or are in process of being controlled; 8 of these are on the public domain in Colorado, New Mexico, and Wyoming, and the remaining

9 are on private lands in Pennsylvania and West Virginia. The Government pays the entire cost of controlling fires on the public domain. However, if a coal fire on private lands is to be controlled, the owner or owners must contribute a third of the cost.

The work of controlling these fires is done under contract and under the supervision of Bureau engineers. It is planned to control numerous other fires in coal beds on the public domain in Western States as funds become available. In the interest of conserving an irreplaceable natural resource the program should be continued until all known coal-bed fires are under control.

Anthracite flood prevention.—During the fiscal year the Bureau carried forward a study to find a feasible method to prevent the loss of all or a large part of the Pennsylvania anthracite reserves through flooding by underground and surface water.

One phase of the mine-water problem in the Northern field of the anthracite region is presented by the buried valley (filled ancient channels) of the Susquehanna River. The present river channel is above those of the ancient waterway, which the north branch of the Susquehanna has filled with clay, sand, and gravel. This valley fill is waterbearing and irregular in shape and depth. The deposited material generally ranges from 100 to 150 feet in depth, in places exceeding 300 feet. The coal measures or anthracite-bearing formations lie beneath and outcrop beneath and at the sides of these deposits.

A study is being made of the coal barrier pillars left underground to support the overburden in about 186 anthracite collieries. This involves the investigation of 6,000 barrier pillars.

An investigation is also underway to obtain the data necessary for estimating the anthracite reserves of the Northern, Western Middle, and Southern fields. This will cover 186 collieries that may be drained by any tunnel or central pumping-plant scheme that might be adopted.

One proposed method of unwatering the anthracite mines involves construction of a concrete-lined tunnel system to drain all the anthracite fields into the Susquehanna River near Conowingo, Md. From Conowingo to the vicinity of Mahanoy City, Pa., the proposed system would consist of two parallel tunnels of horseshoe cross section, each 13 by 13 feet and each having a capacity of 350,000 gallons per minute at a gradient of 2 feet to the mile. From Mahanoy City to Glen Lyon, Pa., where the system would intersect the Northern field, each tunnel would have a cross section of 11 by 11 feet and a capacity of 20,000 gallons per minute at a gradient of 1.44 feet per mile.

There would be 103 miles of main twin tunnels from Conowingo to Glen Lyon and 123 miles of double laterals from the main tunnels to drain the separate fields. Cross-over connections are proposed for the parallel tunnels so that either could handle the full flow in times of low water while the other was being inspected and repaired. These cross-overs are proposed for the points where the lateral intersect the main tunnels.

This proposed tunnel method of draining the anthracite mines of Pennsylvania is of such magnitude that the only present engineering projects of similar nature comparable to it are the Croton and Delaware aqueducts, supplying water to the city of New York, the Hetch Hetchy system of water supply for the city of San Francisco, and the Los Angeles aqueduct supplying water to Los Angeles.

AIR AND STREAM POLLUTION

Problems resulting from the discharge of industrial wastes into the air and into streams, which the Bureau from its inception had been studying to a limited extent, became so serious that at the beginning of the fiscal year a special office was set up to direct and coordinate all activities in this field. The importance of this work had been emphasized in October 1948 by the death of 20 persons and the illness of nearly 6,000 resulting from a smog that hung over Donora, Pa., for 5 days.

To focus attention upon the need for preventing air pollution and to bring together the best-qualified scientists and legal authorities to discuss technical and legal problems involved, the Secretary of the Interior approved a proposal for a United States Technical Conference on Air Pollution. The conference, authorized by the President in a letter to the Secretary dated December 10, 1949, was planned by an interdepartmental group on which were represented the Bureau of Mines, the Public Health Service, the Atomic Energy Commission, the Bureau of Standards, the Weather Bureau, and the National Defense Establishment.

The Conference, first of its kind to be called in the United States, met in Washington on May 3, 4, and 5, 1950. Registration exceeded 750, and the conferees included outstanding scientific and technical representatives of universities, industry, and Federal, State, and local governments throughout the country. The United Kingdom, Canada, and the Netherlands also were represented. The work of the Conference was divided among seven panels: Agriculture, analytical methods and properties, equipment, health, instrumentation, legislation, and meteorology. These panels met simultaneously for 2 days. The third and final day was devoted to plenary sessions.

Asking that the Federal Government continue its interest and support in solving air-pollution problems, the conference adopted a resolution requesting the formation of an advisory council on air pollution, to be composed of representatives of research and educational institutions, industry, and appropriate Federal, State, and local agencies. The proposed advisory council would correlate the activities of all interested agencies and groups and develop a program aimed at the effective and expeditious solution of all air-pollution problems.

The interdepartmental committee has met twice since the conference to consider publication of the proceedings and to discuss the make-up of the proposed advisory council on air pollution.

During the year the Bureau assisted in technical studies of air pollution at Beaumont, Tex., and Los Angeles, Calif. A cooperative agreement was concluded in June 1950 between the Bureau and the air-pollution control district of Los Angeles County providing that the Bureau furnish four or five members of its staff to the district for air-pollution studies for not more than 6 months. Another cooperative agreement, for the development of equipment capable of disposing of radioactive combustion products safely, was entered into between the Bureau and the Atomic Energy Commission.

Three reports relating to acid mine waters were being edited as the fiscal year ended.

PUBLIC REPORTS

The volume of publications prepared and issued decreased somewhat from the previous fiscal year, largely reflecting the smaller number of descriptions of mineral deposits investigated by the Bureau submitted for publication in 1950. The backlog of technical reports and papers that had been withheld during World War II for security reasons had been virtually absorbed.

To fulfill its responsibility for keeping the mineral industries and the public abreast of trends and developments, the Bureau disseminated its scientific, technologic, and economic information among those to whom it would be of value. At the same time, to conserve funds, the number of copies of each report was held to a minimum.

Results of the Bureau's investigations were distributed in the form of printed and processed reports, in papers before scientific, technical, and trade organizations, and in contributions to the technical and trade journals. In summary, 680 manuscripts were edited during the year, compared with 753 during the previous fiscal year. These included 17 bulletins, 117 Minerals Yearbook chapters and indexes, and 19 miscellaneous items, such as handbooks and monthly and cumulative lists of publications—a total of 153 printed reports. In addition, there were 132 reports of investigations, 45 information circulars, and 37 other manuscripts, including Mineral Trade Notes and special reports for the State Department and other agencies. Reports for presentation before technical societies and for publication in the trade press totaled 313. Indexes of nearly 4,000 items each were prepared for Mineral Yearbooks 1947 and 1948, and indexes of subjects and authors that accompanied the text of the cumulative list of publications totaled approximately 33,000 items. The Senate hearings on the Interior Department appropriation bill were indexed for the eighth year.

The number of showings of films from the Bureau's free loan library of educational motion pictures established another all-time record during the fiscal year. Bureau films were exhibited a total of 174,308 times, an increase of 15 percent or 22,411 over the 1949 record of 151,897 showings, itself an all-time high and 14 percent above the number of showings during the preceding fiscal year. The total attendance at showings during the fiscal year 1950 was 12,465,034, up 19 percent from the preceding year. In addition, television audiences that saw Bureau films during the year are estimated to total 10,545,000, up 52 percent from the preceding year.

A total of 758 new copies of films were added to the film library during the year, and 738 copies were withdrawn, owing to obsolescence and ordinary wear. At the end of the year, 6,274 copies of motion-picture films were in circulation, a slight decrease from the 6,277 copies circulating at the end of the preceding fiscal year. These figures break down into net decreases of 21 percent in the number of copies and 27 percent in the number of reels of silent films and net increases of 7 percent in the number of copies and 4 percent in the number of reels of sound films.

Three new films became available for circulation during the fiscal year. They were Missouri and Its Natural Resources, The Oxy-Acetylene Flame—Master of Metals, and The Story of Lubricating Oil.

Bureau of Mines educational films are available in 16-millimeter width, all in sound except for a few of the earlier ones, and many in color. Like all films in the Bureau's free loan library, those added during the fiscal year 1950 were sponsored by industrial concerns, which defrayed all expenses incidental to production and provided the Bureau with enough copies for distribution to schools, colleges, training classes, the armed services, business and civic groups, and other recognized organizations. No charge is made for the loan of films, but the borrower pays transportation charges and for any damage other than ordinary wear and tear.

ADMINISTRATION SUMMARY

During the fiscal year 1950 a comprehensive reorganization of the Bureau of Mines was effected, which was designed to improve efficiency of management and operation and to give greater emphasis to the economics of mineral resources and to the development and conservation of regional resources.

The headquarters staff is responsible for planning program and project proposals as well as developing and correlating programs for the regions that have an over-all national scope. Such programs, when approved by the Director of the Bureau, are executed under the supervision of regional directors, and the work performed is subject to review and suggestions by the headquarters staff.

The field organization consists of nine regional offices, each headed by a regional director who is responsible to the Director of the Bureau for all activities in the region. Region I covers Alaska; each of regions II to VIII, inclusive, covers several States; and region IX carries on the Bureau's programs with respect to foreign minerals. Within each region are field units performing specialized parts of the Bureau's operations, which report to the regional office. These units consist of experiment stations, laboratories, offices of several types, and, in some regions, pilot plants, demonstration plants, and helium-production plants. The field organization varies from region to region, both as to the organization of the regional office and the types of field units, depending on the mineral resources in the region and the Bureau's programs with respect to such minerals.

Authority has been delegated to the various regional directors and to some principal field stations to make appointments and status changes in positions which have been allocated and established as well as to fill vacancies vice such positions and to take additional identical actions on such positions. This authority has been delegated to the field for all positions in GS–1 through GS–7; CPC–1 through CPC–10; and all ungraded positions.

The Office of the Bureau Safety Engineer is charged with the formulation and direction of a program to improve the health and injury experience of employees. There are now six full-time safety engineers and one safety inspector in the three synthetic liquid fuels plants. At each of four stations, two helium plants, and two metallurgical laboratories an employee functions as safety engineer besides carrying on his regular duties.

The injury-frequency rate (the number of disabling injuries per million man-hours of work) was 12.8 for the calendar year 1949. This value is 22 percent lower than for 1948, 26 percent lower than the 5-year average, and 17 percent lower than the lowest for the last 7 years. The severity rate (the number of days of disability per thousand man-hours of work) was 1.67 for the year 1949. Fire losses continued remarkably low both in number and extent of damage. Motor-vehicle accidents in 1949 were fewer by 17 percent than in 1948, and property damage was lower by 52 percent.

After 3 years of concerted effort the fourth year of the general program has shown encouraging improvement in the health and safety of Bureau of Mines employees.

PERSONNEL

On June 30, 1950, there were 4,505 full-time employees in the Bureau of Mines, distributed as follows:

TABLE 1.—*Classification and number of appointees*

	GS[1]	CPC[2]	Total
Departmental	522	10	532
Field	3, 021	952	3, 973
Total	3, 543	962	4, 505

[1] Includes instrument makers, safety instructors, laboratory aids, assistants, etc.
[2] Includes laborers, mechanics, messengers, wage employees, etc.

FINANCE

The total funds available to the Bureau of Mines for the fiscal year ended June 30, 1950, including direct appropriations, departmental allotments, reappropriated balances, and sums transferred from other departments for service work, were $36,773,799. Of this amount, $26,351,227 was expended, leaving an unexpended balance of $10,422,572. On the regular work of the Bureau, $23,807,238 was expended. These figures are subject to revision because of unpaid obligations.

Table 2 presents classified information regarding the financial history of the Bureau for the fiscal years ended June 30, 1947–51.

TABLE 2.—*Bureau of Mines appropriations and expenditures, fiscal years ended June 30, 1947–51*

Fiscal year	Appropriated to Bureau of Mines	Departmental allotments	Funds transferred from other departments	Total funds available for expenditures	Unexpended balances	Total expenditures	Expenditures, exclusive of service item[1]
1947	$16, 000, 515	$7, 800	$1, 641, 243	[2] $26, 052, 579	[3] $10, 114, 009	$15, 938, 570	$14, 885, 652
1948	18, 714, 181	6, 500	3, 068, 284	[3] 21, 788, 965	[4] 1, 623, 519	20, 165, 446	18, 769, 286
1949	27, 020, 990	6, 000	3, 732, 667	[4] 30, 759, 657	[5] 2, 467, 388	28, 292, 296	25, 996, 102
1950	[6] 33, 710, 778	302, 819	2, 760, 202	[5] 36, 773, 799	[7] 10, 422, 572	26, 351, 227	23, 807, 238
1951	34, 592, 031	200, 000	1, 340, 922	[7] 36, 133, 753			

[1] Service items include helium and other investigations and services for other departments.
[2] Includes $3,176,386 unexpended balance reappropriated, and balance of $457,684 receipts from sale of helium and other products.
[3] Includes $6,501,988 unexpended balance reappropriated, and balance of $800,727 receipts from sale of helium and other products.
[4] Includes $81,471 unexpended balance reappropriated, and balance of $720,155 receipts from sale of helium and other products.
[5] Includes $913,300 unexpended balance reappropriated, and balance of $672,322 receipts from sale of helium and other products.
[6] Includes contract authorizations $7,150,000.
[7] Includes $2,443,780 unexpended balance reappropriated, balance of $763,451 receipts from sale of helium and other products, and $7,150,000 contract authorizations unappropriated.

Table 3 gives a statement of the distribution of congressional appropriations to the divisions and branches and the expenditure of these funds in 1950 by Bureau divisions.

TABLE 3.—*Bureau of Mines expenditures, fiscal year 1950*

Division or branch	Salaries and expenses	Operating rescue cars and stations and investigation of accidents	Control of fires in inactive coal deposits	Coal-mine inspections and investigations	Testing fuel	Anthracite mining investigations	Construction and equipment of lignite research laboratory	Construction and equipment of anthracite research laboratory	Synthetic liquid fuels	Production and sale of excess power synthetic liquid fuels	Mineral mining investigations
Office of the Director	$29, 222	$4, 685		$615	$5. 344				$58, 669		$3, 695
Office of Minerals Reports	24, 986	29, 925	$652	123, 697	7, 095	$137			94, 874		
Office of Air and Stream Pollution Research	64	18, 074			7, 245	2, 827			1, 125		
Total	54, 272	52, 684	652	124, 312	19, 684	2, 964			154, 668		3, 695
Administrative Division	103, 799	64, 752	13, 464	79, 248	39, 891	25, 617			515, 119		40, 427
Fuels and Explosives Division:											
Coal Branch	89	65, 908		73, 018	401, 346	70, 357	$600, 148		43, 918		
Petroleum and Natural Gas Branch	191								2, 700, 590		
Synthetic Liquid Fuels Branch	431	12, 770							6, 021, 393	$157, 071	
Fuels Utilization Branch					170, 034						
Explosives and Explosions Branch	37	353, 768									
Total	748	432, 446		73. 018	571. 380	70, 357	600, 148		8, 765, 901	157. 071	
Minerals Division	465			8, 679					8, 024		373, 345
Health and Safety Division:											
Coal Mine Inspection Branch			479, 633	2, 335, 296							
Safety Branch		592, 328				294, 943					
Health Branch		76, 026		97, 785							
Accident Analysis Branch	113	307		26, 432							
Total	113	668, 661	479, 633	2, 459, 513		294, 943					
Total appropriations	159, 600	1, 220. 000	500, 000	2, 745, 000	631, 000	420. 000	705, 910	[1] $300, 000	[2] 16, 350, 694	735, 000	420, 000
Total expenditures	159, 397	1, 218, 543	493, 749	2, 744, 770	630, 955	393, 881	600, 148		9, 443, 712	157, 071	417, 467
Balances	203	1, 457	6, 251	230	45	26, 119	[3] 105, 762	[3] 300, 000	[3] 6, 906, 982	[3] 577, 929	2, 533

See footnotes at end of table.

TABLE 3.—*Bureau of Mines expenditures, fiscal year 1950*—Continued

Division or branch	Investigation and development of domestic mineral deposits	Coal investigations	Oil and gas investigations	Expenses, mining experiment stations	Metallurgical research and pilot plants	Care, etc., buildings and grounds, Pittsburgh, Pa.	Economics of mineral industries	Drainage tunnel, Leadville, Colo.	Helium utilization and research	Helium production	Development and operation of helium properties, (special fund)
Office of the Director	$47, 219		$3, 048	$25, 059	$41, 107		$20, 498				
Office of Minerals Reports	50, 372	$12, 757	5, 217	5, 808	16, 265		689				
Office of Air and Stream Pollution Research				5, 990							
Total	97, 591	12, 757	8, 265	36, 857	57, 372		21, 187				
Administrative Division	165, 332	6, 274	34, 250	132, 371	179, 328	$264, 999	48, 655		$4, 754	$20, 990	$15, 843
Fuels and Explosives Division:											
Coal Branch		236, 466		95, 808			278, 812				
Petroleum and Natural Gas Branch			657, 442				9, 624		93, 802	465, 075	314, 404
Synthetic Liquid Fuels Branch											
Fuels Utilization Branch											
Explosives and Explosions Branch											
Total		236, 466	657, 442	95, 808			288, 436		93, 802	465, 075	314, 404
Minerals Division	1, 732, 969			1, 132, 961	1, 574, 342		520, 351	$52, 729			
Health and Safety Division:											
Coal Mine Inspection Branch											
Safety Branch											
Health Branch											
Accident Analysis Branch							86, 247				
Total							86, 247				
Total appropriations	2, 000, 000	264, 000	700, 000	1, 401, 000	1, 812, 000	265, 000	965, 000	[4] 771, 328	99, 000	486, 143	1, 093, 698
Total expenditures	1, 995, 892	255, 497	699, 957	1, 397, 997	1, 811, 042	264, 999	964, 876	52, 729	98, 556	486, 065	330, 247
Balances	4, 108	8, 503	43	3, 003	958	1	124	[3] 718, 599	444	78	[2] 763, 451

TABLE 3.—*Bureau of Mines expenditures, fiscal year 1950*—Continued

Division or branch	Metallurgical research and pilot plants contributions	Control of fires in inactive coal deposits contributions	Cooperative funds, synthetic liquid fuels program	Payments from proceeds of sales motor-propelled vehicles, etc.	International information and educational activities	Missouri River Basin (reimbursable)	Working funds	Contingent expense	United States dollars advanced from foreign governments, United States information and educational exchange program, Department of State	Totals
Office of the Director				$60						$239, 221
Office of Minerals Reports						$783				373, 257
Office of Air and Stream Pollution Research	$526									35, 851
Total	526			60		783				648, 329
Administrative Division				75		10, 903	$113, 699	$6, 000		1, 885, 790
Fuels and Explosives Division:										
Coal Branch						17, 431	41, 784			1, 925, 085
Petroleum and Natural Gas Branch			$19	660		54, 583	66, 388			4, 362, 778
Synthetic Liquid Fuels Branch			38, 990	636	$75, 853					6, 307, 144
Fuels Utilization Branch							13, 240			183, 274
Explosives and Explosions Branch							279, 004			632, 809
Total			39, 009	1, 296	75, 853	72, 014	400, 416			13, 411, 090
Minerals Division	6, 131			1, 407		119, 539	797, 338		$20, 000	6, 348, 280
Health and Safety Division:										
Coal Mine Inspection Branch		$46, 064								2, 860, 993
Safety Branch							22, 564			909, 835
Health Branch										173, 811
Accident Analysis Branch										113, 099
Total		46, 064					22, 564			4, 057, 739
Total appropriations	57, 953	48, 600	45, 995	2, 838	80, 112	210, 351	2, 257, 577	6, 000	20, 000	36, 773, 798
Total expenditures	6, 657	46, 064	39, 009	2, 838	75, 853	203, 239	1, 334, 017	6, 000	20, 000	26, 351, 227
Balances	[3] 51, 296	[3] 2, 536	[3] 6, 986		4, 259	[3] 7, 112	[5] 923, 560			10, 422, 572

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[1] Contract authorization, unappropriated.

[2] Includes contract authorization, $6,600,000, unappropriated.

[3] Available for expenditure in 1951 fiscal year.

[4] Includes contract authorization, $250,000, unappropriated.

[5] $916,578 of balance is available for expenditure in 1951 fiscal year.

PROPERTY

Property records of the Bureau of Mines, as of June 30, 1950, show accounts as follows:

Automobiles and trucks	$1, 508, 432. 81
Canvas and leather goods	19, 246. 95
Drafting and engineering instruments	87, 134. 52
Electrical equipment	304, 856. 41
Hardware and tools	393, 046. 91
Household equipment	90, 417. 19
Laboratory equipment	5, 057, 224. 83
Medical equipment	39, 212. 18
Office furniture and equipment	1, 481, 879. 40
Photographic apparatus	141, 763. 37
Machinery and power-plant equipment	5, 450, 463. 19
Land, buildings, and improvements	28, 876, 807. 06
Rescue cars and specialized apparatus	557, 269. 80
Total	44, 007, 754. 62

This property is in Washington and at the various field stations and offices of the Bureau.

Geological Survey

W. E. Wrather, *Director*

☆ ☆ ☆

EVER-INCREASING STANDARDS OF LIVING are the result of the expanding economy of our Nation, and the metals and minerals for machines, fuels for power and heat, and the water for power, irrigation, industry, and the home must be found in ever-increasing amounts. The focal point of the Government's activity in the discovery, evaluation, development, and conservation of the Nation's mineral and water resources is found in the Geological Survey. As these resources come from the earth, a thorough knowledge of the principles of geology and engineering is required to meet the demands upon the supply of these materials. The hundreds of projects carried on during the year involve surveys, investigations, mapping, gaging of streams and measurement of underground waters, and a research program designed to achieve new and improved methods and tools for doing the job. However, our information on nearly three-fourths of our country is not adequate for present needs and, at the prevailing schedule, up to 100 years will be required to complete these programs.

GEOLOGIC DIVISION

The program of the Geologic Division carried out under funds regularly appropriated to the Geological Survey was slightly larger than in the previous year, but emphasis continued on surveys and appraisal of the Nation's mineral and mineral-fuel resources. An important development during the year was the expansion of the effort devoted to appraisal of coal resources. Summary reports on coal resources of seven States were either completed or in progress at the end of the year. A start was made toward bringing the program into better balance by enlarging somewhat the staff of consulting specialists in the field of paleontology and stratigraphy and increasing the laboratory space available for their work.

As in the previous year more than half of the work of the Division was done at the request of other Federal agencies and was supported by transferred funds. These activities included geologic surveys and other geologic work of a specialized nature for the Atomic Energy Commission, the Army and Navy, the State Department, and the Economic Cooperation Administration. Work for the ECA, which includes geologic surveys and special assignments in many foreign countries, was increased during the year, and an effort was made to prepare for a considerably larger foreign program in the immediate future.

Mineral Deposits

In order to support a rapidly expanding economy, the Nation's mineral resources must be appraised and new deposits discovered to meet deficiencies and replace deposits being exhausted. In the field of appraisal, the work in the fiscal year 1950 included the preparation of reports distributed to various Federal agencies on certain specific resources and a map showing the geologic environment of the alumina resources of the Columbia River Basin. Studies of the position of the United States with respect to copper, graphite, and talc resources were started. Plans for the immediate future include detailed studies of the resources of more than 12 strategic mineral commodities.

The field program included 91 projects designed to provide geologic data and tools needed for the most effective search for new deposits by private industry and public agencies. The projects had varying emphasis among a group of related objectives, which included detailed geologic mapping and related studies of mining districts, extension of similar studies into undeveloped but potentially mineralized areas, development and testing of new techniques for finding ore, basic research leading to a better understanding of how mineral deposits were formed, drilling and other forms of exploration to obtain geologic information and test structural interpretations and theories of ore concentration, and the compilation of maps and the preparation of comprehensive descriptions covering broad areas or many kinds of deposits. Well over half the program was focused on strategic minerals, special emphasis being placed on commodities and areas about which knowledge is most deficient and on areas that offer the best chances for new discoveries of importance. Exploration for uranium and vanadium deposits on the Colorado Plateau continued on a large scale with funds supplied by the Atomic Energy Commission. Other projects were supported in part by funds transferred by other Federal agencies and by seven States. The base metals copper, lead, and zinc were the chief commodities involved in 29 projects in various States; manganese, chromite, and other ferroalloys were investigated in 9 projects in seven States; and iron ore deposits were studied in Michigan, New York, New Jersey, and Utah. Other metals investigated included mercury, gold, and silver. Among the nonmetals, the chief emphasis was on phosphate deposits in Florida, Idaho, and Montana; beryllium, mica, and other pegmatite minerals in the Black Hills and in the Eastern and Rocky Mountain States; potash in New Mexico; talc in New York and Vermont; and monazite in the Southeastern States. Attention was also focused on bentonite and other clays, bauxite, and numerous other nonmetallic commodities.

Eleven projects involved exploratory diamond drilling. The full economic value of these studies will not be known for several years but the results to date are promising. For instance, recent Survey drilling in the Wisconsin lead-zinc district disclosed zinc mineralization of minable grade in part of the district now inactive. Significant zinc mineralization was also discovered in rock layers below those previously considered favorable for mineralization.

The Survey's continuing research program on geochemical methods of prospecting has reached the stage of practical value to the mining industry. At least eight mining companies to date have undertaken geochemical prospecting projects of their own, in some cases with notable success, which were based in large part on methods developed by the Survey.

Publications in the field of mineral deposits during the year included five professional papers, seven bulletins, and three circulars covering a wide range of topics, such as the structural geology of a large area in Nevada; the pegmatites of Colorado, Wyoming, and Utah; the geology of a number of areas mineralized with manganese, chromite, iron, precious metals, phosphate, corundum, and other metallic and nonmetallic commodities; and other topics of general and technical interest. About a dozen other reports by Survey personnel were published by cooperating State agencies, and 19 reports were published in professional journals. In addition, 22 reports and maps were made available to the public in libraries in various parts of the country.

PETROLEUM AND NATURAL GAS

The Geological Survey has continued to provide basic geologic data for parts of the country that offer promise of additional discoveries of oil and gas. Investigations have been directed mainly toward the acquisition of regional data on geologic conditions that would aid in the search for oil and gas in known and possible producing areas, as such information lays the foundation for exploration by the petroleum industry. During the year 54 projects were in operation in 23 States.

Twelve maps and charts providing basic data as an aid to oil and gas exploration in the Rocky Mountain region, in parts of Oregon and California, northeastern Texas and in Eastern States including parts of Virginia, West Virginia, eastern Kentucky, Ohio, Pennsylvania, and New York, were published during the year. More than 20,000 copies of the available maps and charts were purchased by the public. Twenty-three reports were also transmitted for publication by State geological surveys or in technical and trade journals.

Oil Shale

The Geological Survey continued its studies of the oil shale deposits in northwestern Colorado that are a potential source of large quantities of liquid fuel. An examination of the oil shale resources of most of the Piceance Creek basin to determine the distribution, thickness, and reserves has been completed, and reports are in preparation. Field work is being continued in the north and central parts of the basin to complete the geologic mapping of the deposits.

Coal

Coal constitutes such a large part of our total national energy resources that a sound and adequate knowledge of our coal deposits is essential. The Geological Survey has undertaken for the past several years expanded work on the coal resources of the country in two closely integrated programs. Summary reappraisals by States of all available data on coal reserves are being prepared, and the basic detailed geologic surveys, on which the accuracy and validity of all estimates of reserves depend, are being carried on in Pennsylvania, Kentucky, Indiana, New Mexico, Colòrado, Wyoming, North Dakota, South Dakota, Montana, and Washington. Information is obtained on reserves; the distribution, attitude, and thickness of the beds; and the amount of overburden. Published results of these investigations provide new bases for planning the most effective development of coal.

During the year a report was published on the reappraisal of the coal reserves in Montana, and a complementary map of Montana showing the outcrops of known coal beds classified according to thickness was in press on June 30, 1950. A summary report on the coal reserves in Michigan was also in press at the end of the year, and reports on the coal reserves of Wyoming and New Mexico were in final stages of preparation. A summary appraisal of the coal reserves in Indiana and North Dakota are in progress.

A new coal geology laboratory was placed in operation late in the year at Columbus, Ohio, with the cooperation of the Ohio Geological Survey and Ohio State University. The laboratory will provide paleobotanic and petrographic data regarding various coals. In combination with the field investigations these studies will aid in the delineation of deposits of different types of coal.

Engineering Geology

During the fiscal year 1950 geologic investigations were continued in selected areas where proposed engineering projects will be benefited by surveys of the bedrock and surficial formations. Mapping is carried out on an areal basis and forms part of the over-all program of mapping the geology of the United States. Areal maps that show the distribution of all the geologic formations, supplemented by descriptions of their physical characteristics, supply basic information useful not only for the currently proposed construction project but also for future structures. Basic geologic mapping is combined with serving day-to-day needs of engineers for detailed site information. Federal construction agencies and highway departments call on the geologists for information on depth to rock, sources of sand and gravel, and foundation conditions at sites of proposed highway locations, bridge crossings, overpasses, tunnels, large buildings, and other structures. In Massachusetts and Rhode Island mapping is being carried on under cooperative arrangements with the States. Investigations in Puerto Rico are cooperative with the Puerto Rico Water Resources Authority.

A substantial part of the engineering geologic investigations have been in the Missouri Basin in support of the Department's program for basin development. Several projects started in recent years reached the stage at which preliminary copies of geologic maps were made available to construction agencies active in the basin. Geologic mapping of a strip along the Snake River in southeastern Washington that includes sites of four dams was done in cooperation with the Corps of Engineers.

Geologic mapping of fast-growing industrial areas to provide geologic data pertinent to many types of engineering construction required in expanding urban areas forms part of the engineering geology program. Most active at present is the San Francisco Bay project, which will eventually yield detailed geologic maps of sixteen 7½-minute quadrangles that include the cities of San Francisco, Oakland, and Berkeley. Geologic interpretations have already contributed to relocating roads, aqueducts, and sewage tunnels to avoid landslides; finding sources of riprap, bituminous aggregate, and other road materials; estimating costs of rock excavation in tunnels; predicting foundation problems for proposed buildings and water-control structures; and analyzing causes of failure in existing structures. Characteristic of a city at the opposit extreme of development is Anchorage, Alaska, which was mapped during the past year. Geologic mapping is also in progress in areas that include Portland, Oreg., and Knoxville, Tenn.

Research on geologic processes that affect the safety of engineering structures is a significant part of the engineering geology program. One subject of study is the development of landslides along the shores of reservoirs, which is associated with the change in environment brought about by the filling of the reservoir and subsequent fluctuation in water level. Translations and abstracts of foreign papers on engineering geology prepared in connection with the research activities have been made available to the public by placing them in open file in Washington, D. C., and Denver.

GENERAL GEOLOGY

Most of the Geological Survey's field work is directed toward the appraisal of specific resources in areas known to have actual or potential importance in mineral production. Although geologists have greatly advanced the understanding of the origin and distribution of mineral commodities, many problems remain unsolved, and the ultimate mineral possibilities of most of the country are unknown. Consequently, the Survey devotes part of its efforts in the field to systematic regional surveys in little-known areas and, usually in conjunction with such surveys, carries on fundamental research on geologic processes related to structural geology, volcanology, sedimentation, and soils geology. For convenience, these activities are included under general geology.

Field activities in general geology during the fiscal year 1950 were conducted on a smaller scale than in 1949. Nineteen field projects were in progress in 15 States, Hawaii, and the Aleutian Islands. During the year new geologic maps of Oklahoma and Montana were approaching completion. Index maps of 11 States showing existing geologic mapping and detailed reports on the geology of the District of Columbia and on the petrology of the island of Hawaii were published. The Volcano Letter, a quarterly publication issued cooperatively with the University of Hawaii and the Hawaiian Volcano Research Association, was continued and was devoted almost exclusively to reports on work done by the volcano unit of the Geological Survey.

GEOPHYSICS

Geophysics continues to play a many-sided role in the Survey's program. The work in this field now includes reconnaissance surveys, largely by air, detailed ground geophysical surveys, and research and development aimed at producing increasingly sensitive and precise geophysical instruments and methods for the use of Survey and other scientists.

Organization and staffing of the aeromagnetic section was essentially completed during the year. The increased efficiency is reflected in the resulting 35,000 traverse miles of flight, 25,000 miles of data compiled, 81 maps released in open file, and 46 maps printed for sale to the public. Of special interest was the San Francisco Bay aeromagnetic survey, which will permit tracing of faults under the bay.

A program of magnetic observations in cooperation with the Hawaiian Volcano Observatory was initiated. Striking changes in magnetic intensity preceded the major eruption of Mauna Loa, and it is hoped that the program will provide data on geologic processes and assist in prediction of eruptions. Seismic installations in the Aleutian Islands are furnishing data on the occurrence of earthquakes in that area in a program similarly aimed at obtaining basic information on volcanic processes. Temperature and resistivity measurements in the permafrost at the Arctic Laboratory at Point Barrow have obvious engineering applications.

Mathemeticians in the branch published theoretical studies on the upward continuation of magnetic total intensity anomalies, which is of great importance in the interpretation of aeromagnetic surveys. A portable absolute magnetometer, capable of measuring accurately all components of the magnetic field, has been developed and is now being tested.

Geochemistry and Petrology

Minerals and rocks furnish the data with which the geologist solves many problems, and it is the function of the branch of Geochemistry and Petrology to investigate properties of these materials. The results of these studies furnish facts and theories that help the geologist solve his problems.

The amount of service work performed as an aid to field investigations during the fiscal year 1950 increased substantially over that of the preceding year. The work consisted of thousands of quantitative chemical determinations of elements in rocks, spectographic determinations, X-ray analyses, and mineralogic and petrographic determinations. These determinations were performed largely for field geologists of the Geological Survey but also for other agencies and the general public.

In addition to performing service work, the staff is improving through research its equipment, apparatus, and methods in order to obtain greater accuracy and speed. The installation of analytical laboratories at Beltsville, Md., and Denver, Colo., was completed during the past year.

Notable research developments during the year included rapid field methods for determining lead, copper, zinc, nickel, cobalt, and molybdenum; an electrode cutter for spectographic purposes; an electronic timer for X-ray apparatus; improved microanalytical methods; extended applications of the differential thermal analysis method; the fluorometric determination of aluminum in phosphate rocks; and a dark-field stereoscopic microscope for mineralogical studies.

One of the geochemical studies, concerned with the concentration of minor elements in coal, resulted in the discovery of germanium in high concentrations in Cretaceous logs found in Maryland. The new minerals, frondelite, hühnerkobelite, and wherryite, have been described and a glossary of uranium- and thorium-bearing minerals published during the year. Studies are continuing on the iron borates and clay minerals and the synthesis of certain uranium minerals.

As a result of the installation of an X-ray fluorescence anaylzer during the past year, a method for the precise determination of elements such as niobium, tantalum, rubidium, cesium, hafnium, and zirconium, which were formerly obtained only with difficulty, is now available. A major advance in research facilities is anticipated upon the completion of a mass spectrometer, which will be used in connection with a wide variety of important problems including geologic age determinations based on abundance of lead and uranium isotopes in carnotite ores.

Paleontology and Stratigraphy

The increasing use of minerals and mineral products and the resulting need for geologic surveys have added greatly to the demands for the consultant services of specialists in paleontology and stratigraphy. During fiscal year 1950, however, in order to bring the activities of this branch more into balance with the rest of the program additional specialists have been added by transferring them from other work. A start toward recruiting new personnel has been made, some new and more efficient equipment has been purchased, and additional space has been obtained.

In fiscal year 1950 data were furnished that were in some instances essential and in others contributory to the location and mapping of deposits of metallic and nonmetallic minerals and mineral fuels or to the solution of other geologic or engineering problems in 32 States and 14 foreign countries. These data were supplied by personal investigations by specialists, by the work of specialists attached to field parties, or by written reports on material sent in for examination. Outstanding projects in which branch personnel were engaged in consultant or other capacities included the following: Studies conducted by the Navy Oil unit in Alaska; work done by the Military Geology branch in the Pacific islands; investigations of the phosphate and vanadium-bearing rocks in the northwestern United States; studies of the rocks met with in drilling deep wells for oil in Florida; studies of Cenozoic mollusks from Panama; studies of potential oil shales; and studies in connection with the oil and gas investigations in California, Wyoming, Oklahoma, Kansas, Ohio, Montana, and many other States.

Geologic Investigations in Alaska

The increased public interest in Alaska since World War II continues to mount, and inquiries from individuals, companies, and Government agencies for information on the geology and mineral resources have become more diverse in character. There has been the usual demand for information on gold-bearing areas that have long been the mainstay of the mining industry in the Territory. Interest in coal has been centered on several of the more accessible fields, and has largely been concerned with coking coal, locomotive and power-plant fuels, and the possibility of coal supplies for synthetic fuel production. Requests pertaining to petroleum and natural gas have increased and there has been minor interest in oil shales. Among the diverse types of raw materials involved were iron ore, lead, zinc, tin, limestone, claystone and shale for cement manufacture, gypsum, barium minerals, sulfur, pumicite, clays, shales suitable for expansion to light-weight aggregate, pozzolanic materials, and riprap.

Exploratory geologic mapping and reconnaissance of mineral resources were continued in the lower Kuskokwim region in southwestern Alaska and in the Glacier Bay portion of southeastern Alaska. The detailed study of important mineralized districts was continued in the area from Juneau to Berners Bay, formerly the most productive lode-mining area in Alaska. Similar investigation is also being continued in the Willow Creek district in south central Alaska.

Coal investigations were continued in the Kenai Peninsula coal field in the south coast area and in the eastern part of the Nenana coal field north of the Alaska Range. Brief investigation was made of the Tyonek and Beluga areas west of the Susitna lowland at the head of Cook Inlet, and a number of samples of northern Alaska coals were collected for analytical work in the course of the oil investigations. Work was revived in the Matanuska field because of correlation problems that arose in the course of drilling by the Bureau of Mines on the covered south limb of the Wishbone Hill syncline.

Petroleum investigation is still under way in both northern and southern Alaska. A large number of the personnel are engaged in the northern investigations, which are carried on largely for and financed by the Navy. In the south coast region: Detailed structural work was extended northwest in the Inniskin-Chinitna Peninsula; no field work was done in the Katalla and Yakataga areas, but much was accomplished toward the final report; and reconnaissance was started in the Bristol Bay area for a possible Tertiary oil-bearing basin. Minor investigation of petroliferous material was made in the course of other work in southeastern Alaska.

Other activities undertaken because of immediate needs and on which field work was completed included: Iron ores at Tah and Hunter

Bays in southwestern Prince of Wales Island, the investigation of gypsum at Sheep Mountain, preliminary reconnaissance for shales and limestones in connection with a proposed cement plant in the vicinity of the railroad at Windy, investigations of copper prospects in the upper Yukon River area, and asbestos in the railroad belt, and limestone work in southeastern Alaska.

Reconnaissance investigations were carried on in various parts of the Territory in search of fissionable materials with funds provided by the Atomic Energy Commission, and investigation was begun on the Klukwan iron ores in the Skagway area of southeastern Alaska.

Military Geology

As a continuing contribution to the military preparedness of the United States, the Geological Survey through its Military Geology Branch provides geologic advice to the Armed Forces. Under a cooperative agreement between the Corps of Engineers and the Geological Survey, most of the activity of this branch is directed toward meeting the needs of the Engineer Intelligence Division, Office of the Chief of Engineers.

The Military Geology program consists of several projects, all designed to obtain and interpret geologic and related data as they might affect possible military operations. These programs are currently of two main types—terrain intelligence studies and field investigations in the western Pacific islands, Alaska, and military areas of the United States.

Comprehensive intelligence studies of regions, as assigned by the Corps of Engineers, are conducted by a research staff in Washington. The studies cover a range of subjects, such as terrain, rock and soil conditions, construction materials, water supply, and the influence of geologic factors on different military operations. In fiscal year 1950, 23 comprehensive reports were prepared, as compared with 13 in fiscal year 1949. Approximately 25 additional reports dealing with special topics and smaller areas were also prepared.

In the western Pacific islands, areal geologic mapping was begun on Tinian Island in the Marianas group. Military geologic folios on Okinawa, Palau Islands, Saipan Island, and Yap, based on geologic and soil mapping completed in fiscal years 1948 and 1949, are in preparation.

The characteristics of permafrost and its effect on military engineering were studied in seven selected areas of Alaska. In conjunction with the investigations of permafrost, terrain and vegetation conditions were also studied as part of an effort to find the solution for important military operational problems in Arctic and sub-Arctic regions. Several preliminary reports on this research were completed, and comprehensive military geologic folios on some areas are in preparation. A special field investigation, coordinated with the permafrost project, was begun at Barrow, Alaska.

Geologic investigations of military areas in the United States were continued. Field surveys on geology, soils, terrain, water supply, mineral resources, and construction materials of the Sixth Army Area were completed. Preparation of a military geologic folio on the basic data and their military implications is in progress. A similar folio covering Fort Benning, Ga., is nearing completion.

FOREIGN GEOLOGIC INVESTIGATIONS

The Government's cooperative program for aid in the development of economically underdeveloped foreign areas was extended from the Americas to several projects in the Eastern Hemisphere. The Geological Survey's role in the total program is to aid these governments in assessing their potential mineral wealth and in improving their methods of geologic investigation and exploration, with the ultimate aim of raising productivity and thereby living standards. The work is financed on a divided cost basis with the governments concerned.

Foreign geologic investigations under the Department of State sponsorship resulted in the completion or publication of 12 bulletins, which deal with a wide range of geologic problems in Mexico, Brazil, Chile, and the Dominican Republic. The cooperating foreign agencies were given technical assistance in publishing editions of these reports in their own language.

Geologic investigations in the Western Hemisphere during the year included silver, lead, zinc, phosphate, copper and iron deposits, and volcanic studies at Paricutin in Mexico; iron and manganese deposits in Brazil; lead, zinc, and copper deposits in Peru; earthquake damage in Ecuador; and ground-water studies in Chile. The Chilean Government carried the entire cost of the latter project. At the request and expense of the Venezuelan Government, the Survey built a discharge integrator and furnished detailed plans to permit Venezuela to manufacture enough instruments to serve its entire irrigation program.

In the Eastern Hemisphere, a country-wide survey of all the mineral commodities of Afghanistan, in cooperation with the Royal Department of Mines, was conducted through the year and extended into fiscal year 1951. In Thailand a 6-month reconnaissance of mineral deposits in cooperation with the Royal Department of Mines was completed. In India, reconnaissance investigations of mineral deposits in the State of Orissa and a country-wide reconnaissance of ground-water resources in cooperation with the Geological Survey of India were completed with a view to determining the need for further development. In the Philippines, the long-established minerals exploration program conducted in cooperation with the Bureau of Mines continued through the year with emphasis on manganese resources.

In addition to direct scientific and technical assistance abroad, the Geological Survey extended in-service training in all phases of geology and in administration of research organizations to 25 foreign nationals from 13 countries. This phase of the program is designed to train promising young scientists so that they may directly aid in establishment of advanced research programs in their own countries.

At the request of the Economic Cooperation Administration, the Geological Survey manned and administered three technical projects abroad. Pursuant to the ECA-British Colonial Surveys program, the Geological Survey recruited 14 geologists, mining engineers, and topographers for cooperative work in Africa. In cooperation with the ECA mission to Korea, a four-man geologic staff of the Survey conducted investigations on fuels and minerals in that country. Technical assistance was given the ECA in determining the feasibility of airborne inductive and aeromagnetic exploration in the French African colonies.

Geologic Maps

During the year the Office of Geologic Cartography in Washington, D. C., in conjunction with five of its field units operating in Boston, Denver, Knoxville, Salt Lake City, and Spokane, prepared 1,530 geologic maps, charts, diagrams, and other illustrations for multicolor and black and white reproduction. Final copy for four maps in the new geologic quadrangle series was transmitted to the Map Reproduction Branch during the year. This group included the Brockton, Mass., Winnemucca, and Mount Tobin, Nev., quadrangles. In the same series final copy is in various stages of preparation for seven other quadrangles.

The geologic map editor reviewed and edited 2,044 maps and figures involving more than 200 reports. Some 78 percent of these illustrations were designated for publication by the Survey; the remaining 22 percent were routed for outside publication.

Library

The use of the library facilities during the fiscal year 1950 was greater than in any previous year in the history of the library. About 20,000 readers used the library personally, of which 6,700 readers were non-Survey personnel. A total of 107,422 pieces were circulated during the year, an increase of 15 percent over the previous year. Loans to the Survey staff members increased 25 percent, and interlibrary loans increased 47 percent. More than 20,000 publications were received during the year.

Library service to the men in the field continues in large volume, emphasizing the need for additional regional facilities. The Denver Branch Library is being expanded, with shelving set up for 35,000 volumes. Books and sets of journals are being purchased as rapidly as possible to equip the library for the needs of the men in the Denver area, but the library in Washington still has to supply much material by mail. The offices in San Francisco and Spokane also are building up their collections.

The foreign exchange program continued satisfactorily, and the remainder of material held because of war conditions was shipped to various exchanges during the past year. Several new exchanges were established, notably in Germany, and some were closed. As in the previous year no exchange was carried on with Russia.

The Bibliography of North American Geology for 1948 was delivered in March. The bibliography for 1949 was completed, and the cumulative volume for 1940–49 is being assembled and should be completed this fall. The publication of the bibliography annually was very favorably received by the profession.

TOPOGRAPHIC DIVISION

Topographic mapping has been carried on as a continuing national program since the Geological Survey was organized in 1879 to classify the public lands and to examine the geologic structure. Good topographic maps provide sound knowledge of the Nation's terrain, which is essential for the conservation and development of our natural resources, for the expansion of our industrial economy, and for intelligent planning on a national scale for both military and civilian needs.

During the past 70 years topographic maps have been made of approximately half of the United States. Yet less than 25 percent of the United States as a whole can be considered adequately mapped, and an appraisal made during the past year of all existing maps indicates that only two States, Massachusetts and Rhode Island, and Puerto Rico can be considered completely and adequately mapped.

Considerable credit for what has been accomplished and what will be undertaken in the near future must go to the various States of the Union. Massachusetts, for example, has shared the work and expense of topographic mapping with the Survey since 1884, and a majority of the States have followed in cooperative efforts to expedite mapping.

As the development of the country has progressed, the trend in map requirements has demanded larger scales and greater accuracy. The quality of the maps also is being constantly improved as better instruments are designed and new methods are developed. The maps now being produced by the Geological Survey, therefore, should be adequate for an unlimited period, except for occasional revision required by changes in man-made, or so-called "cultural," features.

Current mapping operations during the past year extended throughout Alaska, the 48 States, Hawaii, and Puerto Rico. The mapping of some 3,300 quadrangles was in progress, and more than 700 quadrangles were completed. At the present rate it will take until about the year 2000 before the entire United States is adequately mapped.

The Geological Survey, as the principal mapping agency of the Federal Government, has received strong endorsement for the immediate expansion of our national mapping program from various State agencies, the Department of Defense, and other organizations and interested groups. The achievement of such an expanded mapping program is dependent on the availability of adequate funds.

Mapping Accomplishments

During the year topographic mapping was carried on in 48 States, the District of Columbia, Alaska, Puerto Rico, and Hawaii. Cooperative mapping projects, whereby half of the mapping funds are supplied by the State and half by the Federal Government, were conducted with 25 States and Puerto Rico. During the year the Survey also continued to assist the Tennessee Valley Authority in its mapping program.

A concentration of mapping efforts continued in the Missouri River Basin, where approximately 10,630 square miles of mapping (6,803,200 acres) were compiled and control surveys were extended over 9,315 square miles (5,961,000 acres).

In all, approximately 51,460 square miles (32,934,000 acres) of domestic mapping was compiled during the year, including 8,150 square miles (5,216,000 acres) of map revision; 49,000 square miles was covered by third-order horizontal control, 39,000 square miles by vertical control, and 34,136 square miles by supplemental control Drafting and editing were completed for approximately 44,000 miles of mapping.

Of the 771 topographic maps reviewed and forwarded for reproduction, 752 were prepared for multicolor photolithography and 19 for copperplate engraving. Until about 10 years ago, all standard topographic maps of the Geological Survey were produced by copperplate engraving methods, but in recent years most of these maps have been produced by more rapid photolithographic methods.

In addition to the new mapping, 558 quadrangle maps, 10 State base maps, and 25 State index maps were prepared for reprint editions. At the close of the year, maps in process of reproduction included 26 for copperplate engraving and 129 for multicolor photolithography. Maps being reviewed or awaiting review by the editors at the close of the year totaled 67, with 537 maps being carried on the agenda for reprinting. Of these maps, only 30 were actually out of stock and these were on the priority list for immediate reprinting.

About one-third of the 661 maps cleared for reproduction were originally compiled by other agencies for special purpose. Of these, such maps as are suitable for general use are edited and published by the Geological Survey for distribution to the public.

Extensive geodetic surveys—the framework for topographic mapping—were advanced during the year. In all, 13,344 miles of spirit leveling, 6,868 miles of transit traverse, and 18,198 square miles of triangulation were completed. These basic surveys were used not only for Government mapping operations but were also made available to the general public.

A considerable amount of supplemental control was also completed, providing for 33,546 square miles of mapping. These surveys were accomplished by the two-base altimeter method, by use of the recently developed mobile elevation meter, and by various vertical angle methods.

Special assignments of mapping and charting for the Air Force continued throughout the year. This work is performed on a reimbursable basis. The over-all program, of which this work forms an important part, is maintenance of adequate world coverage of aeronautical charts, primarily in the interest of national defense.

While chart priorities are established by the Air Force, as are all detailed specifications and other technical requirements, the Geological Survey conducts the editorial review and evaluation of charts, and as requested prepares by photogrammetric methods revised or recompiled base charts preliminary to photolithographic reproduction.

The Trimetrogon Section, in which the special work for the Air Force is conducted, also maintains the only existing world-wide reference library of trimetrogon photographs. This library contains several million oblique and vertical photographic prints from which are obtained the basic information for charting work, as well as reference data required by other organizations whose activities are concerned with geology, forestry, water resources, constructions, engineering development, or national defense.

During the year, approximately 408,000 square miles of entirely new photo compilation were completed as well as photo revision of nearly 114,000 square miles of charts and nearly 112,000 square miles of cartographic compilation, making a total of approximately 634,000 square miles. This charting covered areas in practically every part of the world, involving a total of 172 charts and other items, as follows:

Preliminary charts on a scale of 1:250,000 (foreign)	35
World aeronautical charts on a scale of 1:1,000,000 (foreign)	8
Pilotage and preliminary charts on a scale of 1:500, 000 (foreign)	16
Approach and landing chart on a scale of 1:250, 000 (foreign)	1
Special charts	2
Charts on a scale of 1: 100,000 (foreign)	35
Overlays for mosaics	24
Domestic mosaics	3
Uncontrolled photomosaics (foreign)	48

In addition to these, there were 224 charts in various stages of completion at the end of the year.

As a result of a research project assigned by the military services, work on which has been in progress during the past 2 years, the section completed a manual on chart compilation from radarscope photography together with information as to the interpretation of such photography.

The Special Map Projects Section was engaged in the compilation and preparation for publication of State, sectional, and regional maps on scales of 1:250,000, 1:500,000, 1:1,000,000, and small scales.

Work in progress on the international map of the world, scale 1:1,000,000, was continued on the following sheets: Austin (H–14); Mississippi Delta (H–15); Cascade Range (L–10); Los Angeles (I–11); Savannah (I–17). The Mount Shasta (K–10) and the Lake Erie (K–17) sheets were published. The preparation of additional sheets of this series has been suspended.

Progress continued on the transportation map of the United States being prepared for the Bureau of Public Roads. Work was under way on sheets for Missouri, Kentucky, Mississippi, Tennessee, and Colorado. In various phases of preparation were 8 sheets for Alabama, 15 sheets for Nevada, 9 sheets for Louisiana, and 6 sheets for Ohio. Twenty-two sheets on the transportation map were published, comprising eight sheets for Virginia, five sheets for West Virginia, eight sheets for Indiana, and one sheet for Washington, D. C., and vicinity.

Manuscript copy was transmitted for the reproduction of the topographic and shaded relief editions for New Jersey, Massachusetts-Rhode Island-Connecticut, and Maryland-Delaware, and also of the base map and highway map editions for Oklahoma, Indiana, Iowa, and Illinois. Maps of Puerto Rico and surrounding islands on scales of 1:120,000 and 1:240,000 were prepared for publication. The revision of the 1:500,000-scale State base maps was in progress for Mississippi, New Hampshire-Vermont, New Mexico, and Ohio.

The following topographic quadrangle maps were produced with relief shading as a part of the Geological Survey's program for relief shading of topographic maps that have special physiographic interest: Strasburg, Va., Waldron, Ark., Crawford Notch, N. H., and the special map of the Denver Mountain area. These shaded-relief maps are useful in the classification and study of land forms, and are of particular interest in the study of geology and physical geography.

General Planning

During the year an analysis was made of the Nation-wide map needs as submitted by 15 Federal agencies through the Bureau of the Budget. The findings from this review were then integrated with the special requests received from various State agencies and other map-using groups for the preparation of the 1951 national mapping program. Information on mapping activities was exchanged with various departmental field committees, and the information received from these committees regarding their topographic mapping needs was integrated with other mapping requests.

Estimates and plans for the State cooperative programs were prepared in conjunction with the regional offices. A cooperative program with the State of Kentucky designed to provide that State with complete topographic map coverage on a scale of 1:24,000 within 5 years was started. Other new cooperative mapping agreements were initiated in Iowa, Minnesota, Ohio, Tennessee, and Utah, or municipalities within those States. During the year contracts were awarded commercial firms for stereocompilation of 2,344 square miles in Montana, Wyoming, and South Dakota.

Mapping activities in Alaska were stepped up in line with military requirements and civilian requests. The long-range program of topographic mapping for the Territory was coordinated with the Department of Defense and through the Alaskan field committee with civilian agencies. Studies and planning were continued in order to determine the proper method of revising the topographic maps of the Territory of Hawaii, and field operations were initiated on the island of Molokai.

Research and Development

Writing of a new manual to replace Bulletin 788, Topographic Instructions of the United States Geological Survey, was undertaken. This will be issued in the form of a loose-leaf topographic manual, so that future revisions can be made by chapters. The information can thus be easily kept current.

Development and testing of new methods in utilizing trimetrogon aerial photography for mapping on a scale of 1 inch to a mile were in progress. One 15-minute quadrangle in Utah was mapped by this new method and tested with satisfactory results, and at the end of the year the mapping of four quadrangles in southeastern Alaska was under way. Specifications for map compilation from aerial photographs were written and contracts awarded to commercial mapping organizations for such mapping of five scattered areas in Montana, Wyoming, and South Dakota, covering a total of 2,314 square miles.

The appraisal and classification of all topographic maps prepared, published, and distributed by the Geological Survey and of maps prepared by other agencies and distributed by the Survey were completed during the year. This work involved the examination of nearly 12,000 maps to evaluate their general usefulness and application to the needs of our expanding economy. In order that this classification may be kept up to date, a listing of all new maps produced and the recording of any changes in status of the older maps will be continued at quarterly periods.

Geodetic Surveys

Throughout the year research was carried on to evaluate and devise new survey methods and instruments in order to increase the efficiency of control survey methods in current operations. Methods tested productively included shoran control for determining horizontal position and the use of the radar altimeter for determining vertical control for photogrammetric mapping in remote areas. Other new procedures used in field operations included methods for the establishment of supplemental control from low oblique aerial photography, a more efficient use of the electronically integrating elevation meter, and measurement of traverse distances by subtense base methods.

Experiments were continued on the use of the helicopter in field operations to transport survey parties. Methods were developed for forwarding elevations by vertical angles measured simultaneously from both ends of successive lines of sight, 5 to 10 miles long, with the observing parties being carried by helicopter.

A revised edition of the Instruction Manual for Transit-Traverse Surveys and a new instruction manual entitled "Instruction for Fourth-Order Leveling With the Johnson Elevation Meter" were issued during the year. Tables for converting geodetic coordinates to State plane coordinates by means of a rapid interpolation method were devised for use throughout the United States. Similar tables were prepared for Alaska, consistent with the military universal transverse Mercator projection used for mapping in the Territory. A computing procedure was devised for converting shoran measurements to grid coordinates so that the resulting positions can easily be plotted. The preparation of a manual on supplemental control was undertaken, and considerable control survey data, together with pictures of field operations, were assembled for a training film (in color) on topographic mapping.

The development of a procedure for the audio recording of technical instructions for computing and other office mapping operations was in progress. These audio recordings were used to assist in training new employees. Throughout the year the development of new electronic methods of surveying and of computing survey data were followed closely so that full advantage might be taken of these new techniques for the benefit of the Nation's mapping program.

PHOTOGRAMMETRY

Various projects concerned with the research and development for the improvement of techniques, procedures, and instruments used in stereoscopic mapping were in progress during the year.

A complete redesign of the Kelsh plotter was accomplished. This new stereoplotter is now in production and will be used as standard mapping equipment in all the regional offices.

The prototype of a new double-projection mapping instrument, known as the Twinplex stereoplotting instrument, was completed and exhibited for the first time at the 1950 meeting of the American Society of Photogrammetry. Although the basic theory of this instrument is not new, its unique design will afford the photogrammetrist a more accurate and economical method of map compilation.

A diapositive printer, a device for reproducing the aerial photographic print on glass for stereoscopic projection, is being developed in which distortion compensation is accomplished by the use of an aspherical correction plate in conjunction with an improved projection lens, thus giving a high increase in image quality.

A mapping project, in which a nine-lens camera with a 130° angle of coverage was used, was initiated for the purpose of ascertaining the suitability of the camera for the preparation of small-scale planimetric base maps.

Other projects in various stages of completion included the development of a new projector with an improved light source, an improved plotting table for double-projection instruments, an optical bench designed especially for photogrammetric use, the investigation and development of curved diapositive plates designed to reduce or eliminate distortion, and development of a testing method for determining the visual skills of prospective operators of photogrammetric equipment.

A mapping project conducted in cooperation with the Department of the Air Force resulted in the procurement of approximately 20,000 square miles of aerial photography suitable for standard mapping. An important and unusual accomplishment of this project was that each exposure of this photography was positioned by shoran fixes, thus eliminating to a great extent the need for extensive and costly ground control.

During the year approximately 50,000 square miles of aerial photography for precision mapping in the continental United States was delivered, and new contracts were placed for approximately 49,000 square miles of new aerial photography.

Cartography and Map Editing

The Cartography and Map Editing Section provided technical control of cartography in regard to map-finishing procedures and the determination of style, symbolization, and quality of the finished product. The section also did inspection work, in the form of review editing, to assure that all maps produced conformed to approved standards. This involved the examination of all map copy for accuracy and completeness, as well as for its suitability for reproduction.

Symbol and style guides, as well as formal instructions on several phases of map preparation, were issued during the year. An information folder describing the nature and content of topographic maps, which includes map symbols and other color illustrations, was also prepared. The folder replaces the brief explanatory statement and one-color symbol block heretofore printed on the back of each standard topographic map sheet.

Research for the improvement of compilation and drafting equipment and procedures was a continuing project. New drawing papers and plastics, as well as other materials used in map preparation and reproduction, were tested and otherwise evaluated as soon as they were placed on the market by manufacturers. Any changes in the operating techniques of cartographic agencies in this country and abroad were also examined for possible adoption if beneficial results are indicated. This is becoming more or less a mutual endeavor, as technical groups are making increasing use of meetings and consultations to report upon their problems and accomplishments.

Map Information Office

The increasing demand for maps and related data was reflected in part by the steady increase in the volume of requests for such material. During the year the Map Information office filled approximately 25,000 such requests for information regarding maps of all kinds, aerial photography, and geodetic control surveys. These data are used for administrative purposes and in connection with conservation and development activities of Federal and State agencies, for the construction projects of industry, and for a variety of purposes by the general public.

In order to supply this information considerable effort was devoted to the preparation of special indexes and status maps showing sectional or over-all map coverage according to scale and classification, to the recording of current data on the progress of new mapping and the availability of advance prints, and to the compilation of lists of new maps, geographic data, and reports on Government mapping activities. Attention was also given to the procurement and indexing of the ever-increasing volume of published maps, aerial photography, aerial mosaics, and horizontal and vertical control surveys.

Increasing interest in basic maps was evidenced by the visits of numerous State, industrial, and private engineers seeking data for use in industrial expansion programs and in State or private engineering investigations. Technical assistance and advice were supplied to several State officials interested in activating or developing State map information offices in order to provide first-hand information regarding surveying and mapping data.

The compilation of two new index maps showing the status of topographic mapping in the United States was completed. Based on the appraisal and classification of nearly 12,000 topographic and planimetric maps published by the Geological Survey and other Federal agencies, these index maps give the most comprehensive evaluation of the Nation's map coverage that has ever been published.

The master series of State index maps showing horizontal and vertical control established by the Geological Survey was completed for the 48 States. Photostatic copies of these indexes are available to those having need for such information. Geodetic control data were supplied to other units of the Geological Survey, to the military services, and to other Government agencies, as well as to the public. Among the groups making extensive use of such survey data were commercial engineering organizations, oil companies, aerial survey firms, mining and mineral exploration concerns, and many highway, airport, and other construction organizations.

The supplying of photographic and photostatic reproductions of new mapping in manuscript form prior to publication for engineering and other urgent needs and of early maps or old maps that are out of print showed a substantial increase over last year. Some 550 requisitions for such reproductions, involving the processing of 7,500 prints, were filled, the sales for these exceeding $10,000. In addition, a total of 4,900 prints, requested in 1,180 orders, were supplied without charge for the official use of Federal and State agencies.

Reports on photography holdings continued to come from all sources that prepare or acquire aerial photography and aerial mosaics. In accordance with the established procedure to guard against unnecessary duplication within the Federal Government in obtaining aerial photography, all Federal agencies, as well as many State agencies and industrial concerns, now look to this office for comprehensive information before undertaking new aerial photography or aerial mosaic projects.

The fourth edition of the index map showing the status of aerial photography in the United States was published early in the year. The demand for this information necessitated two reprint editions. Two revised editions of the index map showing the status of aerial photography in Alaska were printed. This index map is available only to Government agencies for official use. The second edition of the index map showing the status of aerial mosaics in the United States was also published.

The series of 13 master base maps of aerial protographic coverage was maintained, 10 of these showing the holdings of Government agencies and 3 showing the photography held by State agencies and commercial concerns. This series represents a cumulative inventory of aerial photography of the United States, which, including duplicate photography, now totals more than 6,250,000 square miles of coverage. These master base maps show the areas covered by aerial photography, date of photography, focal-length of lens, and scale. Photostatic or photographic reproductions of these base maps are available to other Government agencies and the public.

The sale of aerial photographic reproductions has shown a steady increase since the reactivation of the Map Information office. They increased from about $9,000 in 1947 to $56,660 during the past year.

Requests were received for map exhibits in various parts of the country. For the annual meeting of the American Society of Civil Engineers held in Washington during November, the Map Information office prepared a series of display panels showing present-day mapping methods and the various types of published maps, together with samples of advance map copy such as bluelines, composite prints, and other photostatic reproductions available to engineers. An exhibit showing the latest photogrammetric mapping techniques was also prepared for the annual meeting of the American Society of Photogrammetry in Washington in January. An exhibit of topographic maps of special interest to petroleum engineers was supplied for the annual meeting of the American Association of Petroleum Geologists in Chicago during April. Assistance was given in selecting maps, aerial photographs, and other illustrative material for exhibits sponsored by State, county, university, and other local groups.

The scheduling of motion-picture films on mapping was continued. During the year the training film, Multiplex Mapping by Photogrammetric Methods, was shown to nearly 100 technical groups before audiences totaling about 8,000 people.

Map information and research assistance was given through correspondence to Government agencies, universities, and individuals in foreign countries, particularly Canada, Great Britain, Australia, New Zealand, France, Switzerland, Sweden, Norway, India, Pakistan, and Mexico. Throughout the year the office was visited by Government officials, teachers, students, engineers, and others interested in topographic mapping from Iran, Denmark, Belgium, Sweden, Norway, Switzerland, Austria, Japan, Mexico, and Canada.

Areas mapped during fiscal year 1950 for publication on standard scales

[Contour intervals, 5 to 100 feet]

State	Scale			New mapping	Remapping	Revision	Amount of new mapping to June 30, 1950	Total square miles in State	Percent complete
	1:24,000	1:31,680	1:62,500						
Alabama							26, 921	51, 609	52. 2
Arizona			2, 145	813	831	501	36, 477	113, 909	32. 0
Arkansas	47		1, 240	995	47	245	25, 876	53, 102	48. 7
California	1, 883		3, 786	375	4, 713	581	133, 451	158, 693	84. 1
Colorado	1, 649		231	661	1, 162	57	59, 353	104, 207	57. 0
Connecticut		154				154	5, 009	5, 009	100. 0
Delaware							2, 057	2, 057	100. 0
District of Columbia							69	69	100. 0
Florida	417			417			14, 043	58, 560	24. 0
Georgia	226				177	49	25, 202	58, 876	42. 8
Idaho	700		427	641	487		40, 599	83, 557	48. 6
Illinois	138		1, 305	473	124	846	51, 896	56, 400	92. 0
Indiana	966			526		440	11, 645	36, 291	32. 1
Iowa			245	245			14, 679	56, 280	26. 1
Kansas	464		695	459	642	58	66, 770	82, 276	81. 2
Kentucky	1, 332			742	590		28, 764	40, 395	71. 2
Louisiana			1, 183	504		679	21, 118	48, 523	43. 5
Maine			444	21		423	26, 356	33, 215	79. 3
Maryland	270		234		270	234	10, 577	10, 577	100. 0
Massachusetts		909				909	8, 257	8, 257	100. 0
Michigan			497	497			19, 439	58, 216	33. 4
Minnesota	363		439	802			10, 378	84, 068	12. 3
Mississippi			490	490			10, 522	47, 716	22. 1
Missouri	1, 335			63	1, 272		64, 561	69, 674	92. 7
Montana			701	701			41, 688	147, 138	28. 3
Nebraska	395		4, 059	4, 454			39, 681	77, 237	51. 4
Nevada			1, 561	848	713		45, 358	110, 540	41. 0
New Hampshire			445			445	9, 304	9, 304	100. 0
New Jersey							7, 836	7, 836	100. 0
New Mexico	1, 014		96	481	629		37, 819	121, 666	31. 1
New York	1, 300		1		1, 300	1	49, 576	49, 576	100. 0
North Carolina	380		456	624		[1] 812	20, 403	52, 712	38. 7
North Dakota	1, 960		118	704	1, 438		23, 247	70, 665	32. 9
Ohio	173				173		41, 222	41, 222	100. 0
Oklahoma			1, 005	6	779	220	41, 907	69, 919	59. 9
Oregon			704	704			38, 008	96, 981	39. 2
Pennsylvania	39		222		39	222	45, 166	45, 333	99. 6
Rhode Island		79				79	1, 214	1, 214	100. 0
South Carolina	123					123	17, 098	31, 055	55. 1
South Dakota	997			997			21, 747	77, 047	28. 2
Tennessee	797		212	797		[1] 812	27, 575	42, 246	65. 3
Texas	715		569	1, 250	34		97, 735	267, 339	36. 6
Utah	382		276	652	6		21, 470	84, 916	25. 3
Vermont	52	6	293	85	52	214	9, 476	9, 609	98. 6
Virginia			1, 302		901	401	38, 097	40, 815	93. 3
Washington	50		2, 324	385	1, 989		46, 610	68, 192	68. 4
West Virginia	210				210		24, 181	24, 181	100. 0
Wisconsin	6		633	633	6		22, 086	56, 154	39. 3
Wyoming	1, 731		616	1, 909	438		38, 205	97, 914	39. 0
Total	20, 114	1, 148	28, 954	23, 954	19. 021	8, 505	1, 520, 728	3, 022, 407	50. 3
Alaska			2, 536	[2] 127, 359	[3] 167, 631		427, 274	586, 400	72. 8
Hawaii			13		13		6, 435	6, 435	100. 0
Puerto Rico						[4] 251	3, 386	3, 435	98. 8

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[1] Includes 600 square miles mapped on a scale of 1:125,000.

[2] Includes 126,004 mapped on a scale of 1:250,000.

[3] Includes 166,450 mapped on a scale of 1:250,000.

[4] Mapped on a scale of 1:30,000.

NOTE: The "Percent Complete" takes into account all mapping that has been done by the Geological Survey, including some maps made many years ago and now considered only of limited use.

WATER RESOURCES DIVISION

Water is the Nation's most important natural resource. It can be conserved only by using it wisely because it is transient—it cannot be stockpiled. Reservoirs continually lose water by evaporation and seepage; in some reservoirs in the West the amount of water lost may be as much as the amount of water put to beneficial use. Conservation of water therefore means wise use of water. Fortunately, water is a renewable resource. In streams and under ground the supply is being replenished constantly through operation of the hydrologic cycle. That cycle is the circulating system whereby water in the sea and on the land is transformed to vapor in the air and then is precipitated back upon the earth, purified. The process is continuous, but because the rate varies from time to time and place to place the water supply in any one locality is always changing. Streams rise and fall; flood follows upon drought or flood in an irregular pattern; the amount of water stored underground increases and decreases; and the quality of the water changes as it passes over and through the rocks, dissolving minerals from them and picking up its load of sediment. Only by keeping records of these never-ending changes can we know what our water resources are. The collection and compilation of those records is the major work of the Water Resources Division.

In the United States the supply of fresh water has been so abundant that until the last score of years it was considered essentially inexhaustible. The advance of our standard of living has been accompanied by a steadily increasing use of water. Our modern economy is creating demands for fresh water of a magnitude and variety that formerly never were dreamed of; air conditioning is a notable example. Our population is growing steadily, and the per capita use of water is increasing by leaps and bounds—for domestic purposes, for irrigating farms and pastures, for countless industries, and for new uses that are arising continually in connection with high living standards and a growing industrial capacity. An example is the tremendous quantity of water that will be required in the manufacture of synthetic fuels to supplement our oil reserves and in the production of atomic energy. In most of our cities the per capita daily use of water far exceeds the 100 gallons that was regarded as standard a generation ago; it may exceed 1,000 gallons in summer in some communities. In our present economy there is seemingly an almost insatiable demand for water as a raw material, as a processing agent, and as a medium of heat exchange or temperature control. The full utilization of the water supply is so close in some parts of the country that the level of social and economic development dependent upon water already seems to be approaching a ceiling. In the arid regions there is a keen awareness of the critical place of water in determining further growth, and it requires no prophet to see that the area where there is reason for concern is steadily expanding.

The creation by the President of a Water Resources Policy Commission to make a comprehensive study of the many aspects of the current water situation in the country is most timely. The Water Resources Division has prepared a comprehensive report on the water situation in the United States with special reference to ground water at the request of the Commission for use in making its report to the President and has participated in the preparation of numerous other reports for the Commission.

The current status of the Nation's water resources is reported regularly in the Water Resources Review, a monthly press release by the Geological Survey describing water supplies in the United States and Canada. The monthly release is supplemented by a semiannual summary of conditions, and that for the period October to March also contains a summary of snow surveys and status of water storage in reservoirs.

Federal Government's Interest in Water Resources

The problems of water supply and utilization affect such large areas and such wide interests that more and more they are becoming problems of national concern. Therefore the collection of information on water resources is a definite obligation of the Federal Government in close collaboration with all State and local agencies concerned.

During recent years it has become apparent also that, in addition to determining the occurrence and availability of water, the Geological Survey must also determine the extent and methods of developing supplies, utilization, and conservation in areas where the apparent limits of readily available supplies are being reached. At present several projects are under way to appraise the water resources of highly developed areas by correlating utilization and availability of water and estimating the future potentialities of the supplies. Inventories also are being made throughout the country on requirements for water by industries and the total amount of water used by all types of users. The latest estimate of the withdrawal of water from streams, lakes, reservoirs, and underground formations in the United States is about 200,000 million gallons a day, of which about 25,000 million gallons a day is from ground-water sources.

The Federal Government is also a large user of water-resources information. For example, in the Columbia and Missouri River Basins where great multiple-purpose dams and water-development projects are being built and operated, extensive and accurate water-resources information is essential for the economic design and operation of such projects. Likewise, the need for water supplies on the public domain for livestock requires continuing search to maintain adequate supplies.

The period of useful life of large reservoirs on sediment-laden streams has been the subject of much discussion. Studies were completed during the year of data obtained in an investigation that was begun in 1948 to determine the amount of sediment deposited in Lake Mead behind Hoover Dam. This investigation, which was carried out in cooperation with the Bureau of Reclamation and the Department of the Navy, revealed that at the present rate of sedimentation Lake Mead probably would not fill before the year 2380.

A related problem concerning reservoirs, particularly in the West, is their efficiency. Some reservoir sites are unusable because evaporation from their surface would be so great that there would be little water left for beneficial use. As more accurate information is needed on the amount of evaporation from reservoirs, the Geological Survey in cooperation with the Bureau of Reclamation and the Department of the Navy began a comprehensive investigation of evaporation at Lake Hefner, near Oklahoma City. That lake was chosen for the investigation after considering more than 100 others in 17 Western States. It is expected that the methods developed at Lake Hefner will be applicable to other larger reservoirs, including Lake Mead.

The Federal Power Commission requires licensees operating hydroelectric projects to measure the flow of streams used to generate power. The Geological Survey supervised stream gaging on 146 licensed projects during 1950 at the request of the Commission.

The magnitude of the interest of the Federal Government in water-resources information during 1950 is shown by the more than $2,900,000 transferred by other agencies to provide for investigations to be made by the Geological Survey that could not be financed within its own appropriation. Those agencies include the Bonneville Power Administration, Bureau of Reclamation, Bureau of Indian Affairs, Fish and Wildlife Service, National Park Service, Soil Conservation Service, Forest Service, Weather Bureau, Department of the Army, Department of the Navy, Department of the Air Force, Department of State, Department of Justice, Tennessee Valley Authority, Atomic Energy Commission, Reconstruction Finance Corporation, Veterans Administration, and American Battle Monuments Commission.

Cooperation With States and Municipalities

The welfare of the Nation is dependent on agriculture and industry, and the welfare of agriculture and industry depends on adequate water supplies. The information on water supplies collected by the Geological Survey thus benefits all and is available to all. The usefulness of this information to the people living within the area in which it is obtained is so great that for many years they have supplemented Federal appropriations for this work with State and local funds. For this reason the majority of the water investigations of the Geological Survey are made in cooperation with the States and local communities. Most of these investigations must be started well in advance of a project, because many years of records are necessary for the economic planning of a specific project. An adequate record once collected and compiled may be of value for many diverse uses. On the other hand, the operation of hydraulic and industrial plants requires current information about the fluctuations in water supplies.

That the importance of this work is recognized by States and local communities is shown in the way that funds offered by those agencies for cooperation with the Geological Survey have generally exceeded the funds regularly appropriated to the Survey for that purpose. The appropriation for cooperative work in 1950 was $2,940,000. The amounts available for cooperation in the fiscal year 1950 in each State, Territory, and possession are summarized below:

State	*Obligations*	State	*Obligations*
Alabama	$22, 700	Nevada	$32, 659
Arizona	75, 047	New Hampshire	11, 789
Arkansas	51, 187	New Jersey	54, 885
California	164, 498	New Mexico	80, 826
Colorado	44, 400	New York	180, 115
Connecticut	17, 750	North Carolina	52, 112
Delaware	9, 524	North Dakota	33, 934
Florida	89, 597	Ohio	86, 276
Georgia	34, 900	Oklahoma	64, 830
Idaho	47, 356	Oregon	54, 320
Illinois	45, 439	Pennsylvania	134, 623
Indiana	71, 710	Rhode Island	6, 463
Iowa	53, 743	South Carolina	29, 636
Kansas	45, 901	South Dakota	7, 000
Kentucky	67, 558	Tennessee	66, 010
Louisiana	65, 289	Texas	195, 319
Maine	9, 997	Utah	107, 457
Maryland	70, 990	Vermont	7, 260
Massachusetts	37, 417	Virginia	59, 348
Michigan	79, 869	Washington	116, 979
Minnesota	19, 692	West Virginia	19, 887
Mississippi	12, 730	Wisconsin	29, 293
Missouri	23, 496	Wyoming	36, 733
Montana	26, 745	Hawaii	68, 573
Nebraska	46, 320	Total	2, 769, 582

Funds aggregating nearly $9,700,000 were obligated for water investigations in the fiscal year 1950. Of that amount, about 41 percent was appropriated directly to the Geological Survey by Congress, 29 percent was contributed by States and municipalities, and about 30 percent was provided by other Federal agencies.

Field Offices

Water investigations can be made most efficiently from strategically located field offices, and in 1950 the work was conducted from more than 120 principal offices, with one or more in nearly every State and in the Territories of Alaska and Hawaii. This decentralization results in a high degree of efficiency and economy of work and in better service to the public. Close contacts are maintained with local Federal, State, and municipal officials, and the interests of cooperating agencies are served. The Survey's field offices are local sources of information as to available water resources, fluctuating stage and discharge of surface streams, fluctuations of the water table, and the chemical and physical quality of surface and ground waters.

Although the water-resources investigations are conducted along three lines—surface water, ground water, and quality of water—for administrative purposes and for reporting, the activities are so interrelated that only by giving comprehensive attention to all three can a balanced water-resources investigation be made.

Surface Water

The importance of surface water to our country's ever-expanding economy is reflected in the steadily growing requirements for basic stream-flow data. At the end of the year about 6,300 stream-gaging stations were in operation in the States and in the Territories of Alaska and Hawaii, an increase of about 100 during the year. These gaging stations were operated through 43 district offices in cooperation with 178 agencies of States and political subdivisions and with 14 Federal agencies.

The stream-gaging program in Alaska, which was begun in 1947 with the establishment of 7 gaging stations, has been steadily expanding, and 50 gaging stations were in operation at the end of 1950. Occasional measurements of discharge are collected at a number of other locations. It is anticipated that additional gaging stations will be established in succeeding years to meet the needs of several Federal agencies.

Other investigations on the characteristics of the flow of water in streams were made during the year, in addition to the compilation of statistics on stream flow. A comparative study was made to determine the relative merits of the so-called mean-section and mid-section methods of computing current-meter discharge measurements, as a result of which the mid-section method was adopted as official. Flood-frequency analyses were in progress in several districts; one district completed its studies, and the results were published in a State cooperative report. Preparation of reports on the floods of April–June in the States of North Dakota, South Dakota, and Minnesota was begun. Two engineers were detailed to the field from the Washington office to supervise the special computations of flood flows by indirect methods and to render other assistance to the districts involved. It is contemplated that the reports will be ready for distribution in 1951. Several districts conducted studies of low-flow characteristics of small ungaged streams by correlation with adjacent gaged streams on the basis of simultaneous discharge measurements; the results of one such study have been published in a State cooperative report. Measurement of the flow of Blue Spring in Arizona showed it to be of the first magnitude (flow more than 100 cubic feet per second). This spring, at the bottom of the canyon of Little Colorado River, is the only spring of first magnitude known in Arizona and one of only about 65 in the United States. The verification of discharge determined by slope-area and other indirect methods, a program begun in 1949, was continued in 1950.

Progress was made on a program carried on in close cooperation with the Public Roads Administration and various State highway departments to promote better utilization of stream-flow records in solving hydraulic and hydrologic problems connected with highway structures. A committee was appointed to explore the possibilities of improving the annual stream-flow reports so as to make them more useful to users. A provisional report was issued by that committee in June. Suggestions were solicited from Federal agencies, and from some cooperating agencies, consulting engineers, and private individuals. The committee will complete its study in 1951.

In addition to the annual reports on surface-water supply, a report was completed on the hydrology of Massachusetts, and six other project-type cooperative reports were completed and transmitted to cooperating State agencies for publication. New items of equipment were developed in the equipment laboratory to improve the accuracy of or to expedite current-meter measurements. Of special note are a follower-brake type cable car, a computing-type depth indicator, and a special crane for Skagit River in Washington.

GROUND WATER

National interest in ground water, both as an overdeveloped resource in some areas and as a potential source of additional water in others, reached a new high during the year as a part of increasing water consciousness the country over. The Conservation Foundation, New

York, N. Y., sponsored a Nation-wide survey of the ground-water situation as a contribution to appraisal of that situation in relation to other national problems. A ground-water geologist of the Geological Survey was granted leave to take charge of that survey and prepare the report, which was completed in June 1950 and is to be published commercially.

What is probably the most advanced device yet developed for taking undisturbed samples of earth materials from outcrops and test pits was perfected during the year. Each sample is taken in a lucite tube that can be transferred to a permeability-measuring instrument without disturbance of the material. The permeameter, also of the most advanced design ever built, was perfected during the year. An important technique, that of deaerating the water that passes through earth samples in the permeameter, was developed. The presence of air in the water had led in the past to errors of as much as 1,000 percent in permeability determinations in the laboratory.

A paper was completed on qualitative aspects of the relation of soil structure to infiltration and unsaturated flow of water above the water table. Quantitative studies are under way.

A study of the hydrology of Eagle Lake, Ind., produced data for study of the ground-water profile adjacent to the lake as a function of lake level. The study will facilitate predicting the effects on the water table of changes in the stage of this and other lakes. The sonic method was used here, as well as in other areas, for mapping the lake-bottom elevations.

Consumption of water by phreatophytes (water-loving plants) along Salt and Gila Rivers between Gillespie and Granite Reef Dams, Ariz., was determined in a study made for the Corps of Engineers to help evaluate the feasibility of salvaging the water for useful purposes by eliminating the phreatophytes. Predictions of the amount of water available with and without removal of the phreatophytes were made for a 50-year period in the future. In the study, areas of different kinds of vegetation were mapped rapidly and accurately from a low-flying airplane.

Geophysical methods were used to locate water supplies on the water-short Navajo and Papago Indian Reservations. They were used also to help locate a site for a deep test hole at an ordnance depot near Flagstaff, Ariz., in an area where ground water occurs at great depth, drilling is expensive, and it is essential to use all available techniques in locating test holes in order to increase the chances for success. The water table in the test hole was reached 1,250 feet below the ground surface.

A hydrologic reconnaissance of the Green River, Utah, showed important possibilities in evaluating the hydrologic characteristics of stream systems by a careful study of ground-water geology and of stream flow and quality of water at carefully selected stations along the stream.

A study was made of ground-water occurrence in the Arco area, Idaho, with respect both to availability of water for large-scale industrial operations and to ground-water movements in relation to atomic-waste disposal. Research on atomic-waste disposal on Long Island yielded useful data on the behavior of various "tracers" used in mapping ground-water movements. A study made for the Atomic Energy Commission at Valle Grande, N. Mex., showed the presence of large amounts of stored ground water in sediments deposited in the crater of a huge ancient volcano, but only a relatively small perennial supply.

Work in foreign countries by hydrologists of the branch, at the request of those countries and the State Department or other agencies, continued, with projects in Greece, Thailand, India, Arabia, the Azores, Chile, certain islands in the Pacific, and other areas. The flow of foreign hydrologists to this country for training in the methods of ground-water study used by the Geological Survey continued, with representatives from India, Venezuela, Chile, France, England, and other nations.

During the 1950 fiscal year, ground-water investigations were made on more than 400 projects in the States, Hawaii, Puerto Rico, the Virgin Islands, and Alaska. The studies were made from 37 district offices in financial cooperation with 85 State, county, and municipal agencies and 13 Federal agencies. More than 250 formal reports and papers were prepared, and several thousand requests for information on ground-water conditions were answered.

Quality of Water

Pure water does not exist in nature. All natural waters contain mineral matter in varying amounts, depending on the types of material with which the water has been in contact. Because water is a powerful solvent, every drop of rain water carries dissolved atmospheric gases—oxygen, nitrogen, and carbon dioxide. It also carries suspended material, dust, pollen, and smoke. When rain falls, the water running over the rocks and percolating through the soil gathers more and more mineral matter in solution. The uses to which a water supply may be put depend primarily on the quantity of mineral matter dissolved or on the sediment carried by it. Not infrequently a supply may be adequate with respect to quantity but wholly undesirable or even unusable when its quality is considered. Water of unsuitable quality may cause serious industrial losses, owing to corrosion, deterioration of equipment, loss of flow, boiler failure, scaling of equipment, staining and discoloration of materials, and wasting of soap; it may cause deterioration of recreation facilities and property; it may destroy fish life; and it may be unsuitable for use in the manufacture of foods, beverages, textiles, and ice and in bleaching, dyeing, and tanning processes.

During fiscal year 1950, the chemical quality of nearly 40,000 samples of water was determined in the central laboratory in Washington, D. C., and in the 11 field laboratories located throughout the country. These data, together with analyses made in previous years, provide a growing storehouse of factual information concerning the chemical composition of the Nation's water resources. Continuing records are invaluable in determining the changes in quality of streams and underground waters as a result of agricultural development, industrial concentrations, and other activities of man. Cooperative investigations of the chemical quality of surface waters were in progress in Arkansas, Colorado, Delaware, Florida, Iowa, Kentucky, Louisiana, New Mexico, North Carolina, Ohio, Oklahoma, Pennsylvania, South Carolina, Texas, Utah, and Virginia. Samples for chemical analyses were collected daily at 170 stations on streams in connection with these programs. In addition, samples were collected on an intermittent basis at 170 stream-sampling sites. Samples were also analyzed for cooperative studies of ground water in the above-mentioned and other States.

Factual data concerning the adequacy of the water supply for municipal or agricultural uses or with respect to corrosiveness or scale-forming properties of the waters are essential in sound development of Federal projects and the protection of federally owned equipment of plants. Water samples were examined, and analytical results, interpretation of analyses, or advice about water problems were furnished to the following Federal agencies: Atomic Energy Commission, Bureau of Reclamation, Bureau of Mines, Fish and Wildlife Service, Department of the Navy, Veterans' Administration, Public Housing Administration, and Federal Works Agency. The Geological Survey's laboratories also made analyses regularly for the Department of the Army and the Department of the Air Force in connection with investigations of scale and corrosion problems involving threshold treatment of water supplies at defense installations. During fiscal year 1950 more than 3,000 analyses were made at the request of the above-mentioned agencies, of which nearly 700 were analyses of samples collected at defense installations in this country and at offshore bases.

The importance of measuring the large quantities of sediment transported by the rivers of this Nation is rapidly becoming more widely recognized. The demand for the construction of large dams to impound greater quantities of water in reservoirs for irrigation, power development, and industrial use has focused attention on the probable useful life of these reservoirs. As the greater part of the sediment carried in streams is dropped in the reservoirs, it is essential that systematic studies be made to determine the quantities of sediment that will have to be taken into account in the construction of the dams and operation of the reservoirs.

During the past year the extent and scope of sediment-measurement activities of the Geological Survey were extended slightly to include small investigations in Texas. Sediment samples were collected daily or more frequently at 138 stations on streams in the Rio Grande and the Colorado, Missouri, Washita (Okla.), Schuylkill (Pa.), Canadian, Red River (Okla.), Colorado (Tex.), and Brandywine (Del.) River Basins. In addition, miscellaneous sediment samples were collected on an intermittent basis at 41 stations in these river basins. In all, more than 100,000 samples were collected and analyzed for their sediment content during the year in laboratories at Albuquerque and Tucumcari, N. Mex.; Lincoln, Nebr.; Riverton and Worland, Wyo.; Norton, Kans.; Dickinson, N. Dak.; Stillwater, Okla.; Schuylkill Haven and Philadelphia, Pa.; and Austin, Tex.

MISSOURI RIVER BASIN

The coordinated projects of the Bureau of Reclamation and the Corps of Engineers, Department of the Army, for the development of the Missouri River Basin require extensive water investigation in that basin. The investigations are generally conducted in cooperation with States and municipalities. Additional activities to meet the needs of the departmental program include measurements at 246 stream-gaging stations; 44 projects related to ground-water supplies or to changes in ground-water conditions that may result from reservoir construction or irrigation in the vicinity of reclamation units; more than 50,000 measurements of the sediment content of surface waters at 84 regular stations and 41 stations for miscellaneous measurements; 5,800 analyses of the chemical quality of the waters at 5 regular stations and at 88 stations for miscellaneous records; 800 chemical analyses of ground waters from various sources; and hydrologic and utilization studies related to the proposed plans of development. The information obtained through these investigations is furnished to the above agencies currently or periodically as desired.

INTERSTATE COMPACTS

Interstate compacts, for division between States of waters of interstate streams, which authorize or require the establishment and operation of gaging stations, generally by the Geological Survey, are now in effect for Colorado River (Wyo., Utah, Colo., N. Mex., Ariz., Nev., Calif.), Belle Fourche River (Wyo., S. Dak.), Republican River (Nebr., Kans.), Rio Grande (Colo., N. Mex., Tex.), Costilla Creek (Colo., N. Mex.), Cheyenne River (S. Dak., Wyo.), Pecos River (N. Mex., Tex.), and Arkansas River (Colo., Kans.). Similar compacts are in process of negotiation for Yellowstone River (Mont., N. Dak., Wyo.) and Bear River (Idaho, Utah, Wyo.).

International Treaties

International problems related to water are increasing. The Geological Survey, using funds transferred by the Department of State, makes the water-resources investigations along the Canadian boundary that are required by orders issued by the International Joint Commission, United States and Canada, under the treaty of January 11, 1909. In addition to these continuing investigations needed for division and control of waters along the international boundary, several special investigations were made in 1950 in connection with references before the Commission, particularly those relating to the Columbia River Basin, Sage Creek, Mont., Waterton and Belly Rivers, and Souris and Red Rivers. The Geological Survey, through agreement with the Department of State, has continuing obligations for obtaining water-resources information along the Mexican boundary as required by the Mexican water treaty of 1944. Members of the Geological Survey serve on several international engineering boards.

Reports on Investigations

The results of the varied studies and computations made by the Water Resources Division are made available for public inspection as soon as practicable by placing manuscript copies of observations, measurements, chemical analyses, and interpretive reports in the open files of the district offices concerned. The availability of this information is announced through press releases. Stream-flow and ground-water conditions in the United States and Canada are summarized monthly and semiannually in the Water Resources Review.

The published work of the Water Resources Division during the fiscal year 1950 consisted of 32 new water-supply papers, a large number of shorter reports in the technical press, and 62 reports transmitted to cooperating State agencies for publication by them. In addition, a number of miscellaneous processed reports were issued.

CONSERVATION DIVISION

The Conservation Division classifies the public lands of the United States as to mineral and water resources and supervises mineral recovery operations under leases, permits, and licenses on public, acquired, Indian, and naval petroleum-reserve lands. The Division maintains a small headquarters staff in Washington and a field staff of competent geologists and engineers in strategic centers of mineral-resource development. This investigative, supervisory, and regulatory force makes field surveys, prepares maps and reports dealing with water power, fuels, minerals, and chemicals essential to the mineral-resource economy of the United States, and conducts on-site supervision of mining and drilling operations essential to the economical and safe production of coal, oil, gas, and other minerals, all to the end that this Nation's mineral resources shall be developed and produced by private enterprise in accordance with approved methods and in compliance with accepted conservation practices under applicable Federal legislation.

Mineral Classification

In response to the continuing demand for increased supplies of mineral fuels, fertilizer ingredients, and basic chemicals from lands and deposits owned by the United States and for other types of public land for agricultural, grazing, or residential use, all phases of the service rendered by the Mineral Classification Branch in the administration of Federal lands were maintained at an active pace throughout the fiscal year 1950.

In all, some 15,897 cases involving either the outright disposal of Federal lands with no reservation of any mineral, the disposal of such lands with the reservation of one or more specified minerals, or the exercise under the Federal leasing laws of the Government's right to explore for and produce one or another mineral substance from lands under its jurisdiction were acted upon during the year. This represents a decrease of about 36 percent in mineral reports rendered in 1950, compared with 1949, which is attributable almost wholly to diminished interest on the part of the public in the acquisition of oil and gas leases in the face of a threat of overproduction of oil and gas. In addition, the Branch prepared and promulgated initial or revised definitions of the known geologic structure of 16 producing oil and gas fields containing Federal land and revoked one such definition; appraised geologically 82 unit-plan or participating-area submissions; drafted 45 determinations of leasehold relations to the productive limits of oil and gas deposits as found to exist on August 8, 1946, pursuant to sections 4 and 12 of the act approved on that date (60 Stat. 950); reported for appropriate administrative action the fact and geologic significance of 76 new discoveries of oil or gas on or affecting Federal lands; and reclassified as noncoal 11,455 acres in Utah formerly classified as coal land.

From field offices in Colorado, Wyoming, Montana, Utah, California, New Mexico, and Oklahoma, respectively, branch geologists made numerous "spot" investigations precedent to public-land and mineral-leasing law administration, which resulted in sundry reports and maps for official use in the Branch, other branches of the Conservation Division, the Department of the Interior, the Department of Justice, and the National Military Establishment; in a published map of the geology of the Mush Creek and Osage fields and vicinity, Weston County, Wyo.; and in the approval for publication of a map of the geology of the Dove Creek area, Dolores and Montezuma Counties, Colo. One Branch geologist remained on detail to the Department of Justice the entire year assisting in the case of the *Confederated Bands of Ute Indians* v. *The United States*, No. 45585 in the United States Court of Claims.

WATER AND POWER CLASSIFICATION

The field work of the Water and Power Branch during 1950 was directed principally toward obtaining basic information on the water-power resources and storage possibilities of Federal lands on which projects were proposed for early development. Work was done in Alaska, in the Missouri, Colorado, and Columbia River Basins, and in California. Topographic surveys were made of two reservoir sites and 90 miles of river channel. Supervision of construction and operation was given to 152 power projects under license with the Federal Power Commission, to 322 such projects under permit or grant from the Department of the Interior, and to 177 in cooperation with the Bureau of Indian Affairs.

Classification activities resulted in the addition of 52,595 acres to power-site reserves and elimination of 21,355 acres, increasing the outstanding reserves in 23 States and Alaska to a net total of 6,847,618 acres.

Maps published covered 300 miles of stream channel of eight rivers, three dam sites, and three reservoir sites.

Final action involving hydraulic determination was taken on 504 cases received from departmental sources and the Federal Power Commission and on 3,448 cases that also involved mineral classification.

Investigations were in progress on the power and water-storage possibilities of 34 rivers. Three reports on power possibilities of certain streams were completed and made available for public inspection. Reservoir site reserves in nine States remain unchanged at 137,172 acres.

MINING

The Mining Branch is responsible for the supervision of operations concerned with the discovery and production of coal, potassium, sodium, phosphate, and oil shale from all public-domain lands; of sulfur on public lands in Louisiana and New Mexico; of silica sand on certain lands in Nevada withdrawn by Executive Order 5105; of gold, silver, and mercury on Spanish land grants; of all minerals except oil and gas on segregated, restricted, and tribal Indian lands; of mineral deposits on acquired lands throughout the United States under the act of August 7, 1947, and the provisions of section 402 of the President's Reorganization Plan No. 3 of 1946; of vanadium under departmental authorization on public lands in Wyoming; and of copper, manganese, uranium, asbestos, limestone, gravel, sand, marble, silica rock, iron, gypsum, vermiculite, pumice, clay, fluorspar, feldspar, lead, zinc, barite, mica, tungsten, and garnet from Federal and Indian lands.

The branch is charged with the responsibility of reporting on applications for leases and prospecting permits, recommending lease terms, enforcing regulations and lease terms governing the conduct of prospecting, mining, beneficiation operations, and the safety and welfare of employees, protecting the natural resources, preventing waste, determining royalty liability of lessees and permittees, preparing statements of accounts, and receiving payments of royalties and rentals. The branch acts in an advisory capacity to the Secretary and to other bureaus of the Department in the handling of leases, permits, and licenses.

As of June 30, 1950, there were under supervision 1,209 properties under leases, permits, licenses, and secretarial authorizations, of which 908 were on the public domain, 85 on acquired lands, and 216 on Indian lands. These involved lands in 17 States west of the Mississippi River, 12 Eastern States, and Alaska. Production under supervision during the fiscal year is estimated at 12,914,000 tons, valued at $82,025,000, with accrued royalties of $2,600,000, indicating a decrease over the preceding year of 3,093,000 tons in production, $17,900,000 in value, and $432,000 in royalties. Total income, including royalties, rentals, and bonuses, is estimated at $2,763,000.

The production of coal from public lands in the United States and Alaska, including the former Chickasaw-Choctaw segregated coal lands in Oklahoma purchased by the Government from the Indian owners on May 1, 1949, was approximately 7,072,000 tons, compared with 9,190,000 tons mined during the previous fiscal year from the same lands. The decrease in production was due to strikes of mine workers and increased competition of other fuels.

Potassium production is estimated at 4,400,000 tons of potassium salts, as compared with 4,952,930 tons during the fiscal year 1949. For the third year it exceeded in value the production of coal from all public-land leases. The decrease in tonnage was due to prolonged strikes of potash mine workers in New Mexico. During the year 142 core tests were made in prospecting operations in New Mexico, and the known potash reserves were increased. The number of potassium permits in effect in all States on June 30, 1950, was 270 as compared to 177 on June 30, 1949. A new lessee started sinking a shaft in New Mexico during the year, and another potash company is planning to develop its lands at an early date.

The principal source of sodium from public lands is the Searles Lake brine deposit in California, the production being under the provisions of potassium leases. Refined salts produced from these brines include potassium chloride, borax, soda ash, salt cake, bromine, burkite, and sodium lithium phosphate. During the year operations under 95 sodium prospecting permits were supervised in the States of California, Nevada, New Mexico, North Dakota, Oregon, Utah, and Wyoming.

Phosphate leases on public lands in Arizona, Idaho, Montana, Nevada, Utah, and Wyoming increased in number from 17 to 29 during the fiscal year. In addition there are 33 phosphate leases on Indian lands in Idaho. The total production increased from 418,181 tons in 1949 to 428,452 tons in the fiscal year 1950. Two electrical furnaces were operated at Pocatello, Idaho, for the manufacture of elemental phosphorous for industrial use.

Lead and zinc concentrates produced from restricted Quapaw Indian lands in Oklahoma amounted to 47,965 tons, as compared with 51,404 tons for the fiscal year 1949. Lower-grade ore and lower prices during most of the year account for the decline.

Fluorspar produced in Illinois was the principal product from acquired lands. Other minerals obtained through acquired land leases are coal, silica, feldspar, mica, and asbestos. Prospecting for barite was continued in Arkansas and Missouri. It is in great demand for use as heavy mud in deep-well drilling for oil and gas.

Appraisals were made to determine the present worth of 38 tracts of coal lands in Oklahoma in connection with the sale or removal of restrictions on allotted Indian lands, and assistance was rendered in the appraisal of ceded Ute Indian coal lands in western Colorado.

The effectiveness of the supervision by the Geological Survey is reflected by the character of the operations and by the cooperation obtained from management and employees in enforcing safety regulations. This is attested by the 5 awards of the Joseph A. Holmes Safety Association to coal mines on Government lands as compared with a total of 74 such awards in 1949 to the entire bituminous coal industry in the United States. Furthermore, one of the five mines awarded certificates of achievement in safety in the national safety competition of bituminous coal mines in the United States, operated on Government lands. Under the industrial minerals group one potassium lessee received a Joseph A. Holmes Safety Association award.

Oil and Gas Leasing

The Oil and Gas Leasing Branch supervises operations for the discovery, development, and production of crude oil, natural gas, and products extracted from natural gas on public lands under the act of February 25, 1920, as amended and supplemented; acquired lands under the act of August 7, 1947; tribal and allotted Indian lands subject to departmental jurisdiction, except the Osage Nation in Oklahoma, Naval Petroleum Reserve No. 2, and certain Federal lands excepted from the 1947 act, jurisdiction over which as to oil and gas leasing and operations has been transferred by other departments to the Department of the Interior. During the year these duties were accomplished through field offices and suboffices, 22 at the beginning of the year and 21 at the end, in California, Colorado, Montana, New Mexico, Oklahoma, Utah, and Wyoming.

On the public lands 28,918 oil and gas properties were under supervision at the end of the fiscal year, aggregating 23,555,075 acres in 22 States and Alaska, an increase of 36 percent in the number of properties and 24 percent in the acreage under supervision at the close of the previous fiscal year.

Drilling on public lands during the year included the spudding of 810 wells and the completion of 829 wells, of which 581 were productive of oil and gas and 248 were barren. In all, 15,049 wells, including 8,506 capable of oil and gas production, were under supervision on June 30, 1950. The production from petroleum deposits of the public lands during 1950 was somewhat less than during 1949. Production from public lands during the year amounted to about 76,000,000 barrels of petroleum, 123,000,000,000 cubic feet of natural gas, and 152,000,000 gallons of gasoline and butane, rendering royalty returns of approximately $21,637,000 to the United States.

Drilling on acquired lands during the year included the spudding of 43 wells and the completion of 40 wells, 23 of which were productive of oil or gas and 17 of which were barren. In all, 150 acquired-land wells, including 112 capable of oil or gas production, were under supervision on June 30, 1950. The production from acquired lands during the fiscal year amounted to about 1,204,000 barrels of petroleum, 569,214,000 cubic feet of natural gas, and 1,428,000 gallons of gasoline and butane, rendering royalty returns of approximately $300,000.

On Indian lands the Branch supervised operations on 6,552 leaseholds in 12 States, which contained at the end of the year a total of 8,241 wells, 4,110 of which were productive of oil or gas and 275 of which had been completed during the year. Total revenue from royalties, rentals, and bonuses amounted to $6,992,000.

On behalf of the Department of the Navy, supervision was continued in 1950 over operations for the production of oil, gas, gasoline, and butane from 20 properties under lease in Naval Petroleum Reserves Nos. 1 and 2 in California. Production from 254 active wells on reserve No. 2 aggregated 2,742,000 barrels of petroleum, 1,064,000,000 cubic feet of natural gas, and 7,143,000 gallons of natural gasoline and butane, having an aggregate royalty value of $945,450.

Statistics on lands heretofore reported as Department of the Army lands in the Rio Vista field, California, are now included in the figures for acquired lands under the act of 1947. Leasing on several tracts of transferred lands (excepted by the act of 1947) was in progress at the end of the year, but leases had not been issued. Many oil and gas appraisals and reports were made for the Army, the Navy, the Air Force, and the Alien Property Custodian. Some auditing of operating costs on leaseholds was done for the Alien Property Custodian.

Activities toward unitization of oil and gas operations involving Federal land were reflected in the approval of 32 new unit plans during the year and the termination of 45 previously approved unit plans, leaving 181 approved plans, covering 2,751,817 acres, outstanding on June 30, 1950. About 53.61 percent of the petroleum, 47.65 percent of the natural gas, and 74.29 percent of the gasoline and butane obtained from public lands during the year were produced under approved unit agreements. In addition there were two such approved plans covering 6,380 acres of Indian land outstanding on June 30, 1950. No new Indian-land unit agreements were approved during the year. There were also 28 drilling-unit agreements (commonly referred to as communitization agreements) approved during the year, making a total of 104 approved as of June 30, 1950. These agreements involved isolated small tracts, which are consolidated to form a logical drilling unit and, in effect, constitute an agreement similar to a unit agreement, though involving only a small segment of a single field or pool.

WORK ON PUBLICATIONS

Texts

During the year 140 new manuscripts were received by the Section of Texts, 148 manuscripts were sent to the printer, and 147 publications were delivered by the printer. Work on these included 11,101 pages of manuscript edited and prepared for printing; 3,912 galley proofs and 7,450 page proofs revised and returned; indexes prepared for 38 publications, covering 3,619 pages and consisting of 8,524 entries. Copy edited in preparation for mimeographing included 14 press releases, consisting of 25 pages, and 102 pages of miscellaneous material.

Reports delivered were as follows: Professional Papers 214–D, 216, 219, 221–A, 221–B, 221–C, 221–D, 224, 225, and 227; Bulletins 948–B, 948–C, 948–E, 955–B, 955–C, 960–F, 961, 962–A, 962–C, 963–A, 964–A, 964–B, 964–C, 965–A, 966–B, 966–C, 966–D, 967, 968, and 976–A; Water-Supply Papers 968–D, 1028, 1029, 1030, 1051, 1053, 1055, 1056, 1065, 1066, 1067, 1069, 1070, 1071, 1073, 1074, 1075, 1076, 1078, 1079–A, 1079–B, 1082, 1083, 1084, 1086, 1087, 1088, 1089, 1090, 1091, 1094, 1099, 1103, and 1105; and Circulars 34, 38, 43, 47, 49, 50, 52, 53, 54, 55, 56, 59, 60, 61, 62, 63, 64, 65, 66, 68, 69, 70, 71, 72, 73, and 74. These cover a wide range of subject matter: General geology of particular areas; mining districts and local mineral deposits in the United States, Alaska, Brazil, Hawaii, Mexico, and Palau Island; studies of fossils and the rocks in which they are found; a collection of papers on geochemical research; geophysical abstracts, a quarterly serial; measurements of stream flow and of water level and artesian pressure in wells; general studies of underground water and of the occurrence of floods, with consideration of the influence of geology and physiography.

In order to keep the public informed 12 lists of new publications were issued. Also printed during the year were 20 State index circulars; 23 pamphlets to accompany index circulars; 2 geologic quadrangle maps (Mount Grace quadrangle, Massachusetts, bedrock geology, and Mount Grace quadrangle, Massachusetts, surficial geology); and First Supplement to Publications of the Geological Survey, 1948.

Illustrations

Of a total of 40 reports on hand at the beginning of the fiscal year, 19 were in various stages of completion. Twenty-four reports were received and 40 were completed and transmitted, leaving a total of 24 reports on hand, 21 of which were in various stages of completion. Those transmitted included 15 professional papers, 19 bulletins, and 6 water-supply papers, which contained 1,613 completed drawings and photographs. In addition 232 miscellaneous pieces of drafting were completed.

Map Reproduction

During the year 12 newly engraved topographic maps, 772 multicolor topographic maps, 34 river survey maps, 18 planimetric maps, 11 geologic index maps, 17 topographic index maps, 77 geologic preliminary maps, and 24 special maps were printed, making a total of

965 new maps printed and delivered. Reprint editions of 371 engraved topographic maps, 38 multicolor maps, and 198 photolithographed State geologic, planimetric, preliminary, and other maps were printed and delivered. Of new and reprinted maps, 1,572 different editions, amounting to 3,565,571 copies, were delivered.

A large amount of work was done for 39 other units of the Government, including branches of the Geological Survey, and the States. The charges for it amounted to about $156,316.03, for which the appropriation for engraving and printing geologic and topographic maps was reimbursed.

Transfer impressions and velox and plate prints numbering 484 were made during the year.

Of topographic maps and contract and miscellaneous work of all kinds, a grand total of 3,703,812 copies were printed and delivered.

The photographic laboratory made 10,522 negatives, 10,920 prints, 5,580 photolith press plates, and 776 lantern slides, and developed 37 film packs and 197 rolls of film, and developed and printed 29,600 feet of aerial film.

Map Distribution

In order to facilitate the distribution of maps to the public, the Geological Survey last year established map distribution offices at the Federal Center, Denver, Colo., and in downtown Denver and Salt Lake City. The Denver distribution center stocks and fills orders for all maps of areas west of the Mississippi River. The distribution offices at Denver and Salt Lake City were installed to satisfy a large local demand for maps.

The map distribution office at Salt Lake City was established on an experimental basis. If it is a success other distribution offices may be designated.

A summary of the distribution activities of the Geological Survey follows.

During the year the section received a total of 1,728 publications, comprising 90 new book reports and pamphlets and 7 reprints; 21 preliminary maps and charts in the oil and gas and strategic minerals investigations series and 49 in the geophysical investigations series; 11 geologic map indexes; 9 river surveys; 940 new or revised topographic and other maps and indexes (including 156 maps turned over to the Survey by the Army Map Service and the Tennessee Valley Authority); 46 Tennessee Valley Authority maps with contours; and 555 reprinted maps.

The total units received numbered 137,862 books and pamphlets (including 3,887 reprints), 63,200 copies of revised index maps, and 3,564,025 topographic and other maps, a grand total of 3,765,087.

The section distributed 156,282 books and pamphlets, 898 geologic folios, and 1,461,811 maps, a grand total of 1,618,991, of which 838 folios and 1,045,710 maps were sold.

The breakdown of maps distributed is as follows:

Washington	933, 505
Denver	519, 782
Other field offices	8, 524
Total	1, 461, 811

The net proceeds from sales of maps and folios were $161,602.05. In addition, $28,460.49 was repaid by other Government agencies for maps or folios furnished. The total net receipts, therefore, were $190,062.54, an increase of $28,232.36. Local Washington over-the-counter sale of maps to 9,329 private individuals was $6,406.98, an increase of $518.23 over last year. The section handled 74,383 letters.

The breakdown of money received is as follows:

Washington, D. C	$123, 715. 38
Denver	33, 431. 87
Other field offices	4, 454. 80
Total	161, 602. 05

	On hand July 1, 1949	Received	Distributed	On hand June 30, 1950
Geologic folios	14, 120		898	13, 222
Maps	17, 891, 263	3, 627, 225	1, 461, 811	20, 056, 677
Publications				
Complete volumes	127, 718	84, 698	76, 220	136, 196
Separate chapters, extracts, and miscellaneous pamphlets	177, 713	111, 775	80, 062	209, 426
Total	18, 210, 814	3, 823, 698	1, 618, 991	20, 415, 521

EQUIPMENT DEVELOPMENT

Considerable progress has been made in the past in bringing into sharper focus the developmental aspects of property management. The Instrument Development Section was organized within the Branch of Service and Supply to aid in the development of specifications, the testing and inspection of new instruments, technical procurement work on standard equipment, and the improvement of standard instruments and perfection of new instruments. The section works closely with the Property Maintenance Section in accomplishing this.

In the past year the Property Maintenance and Instrument Development Sections investigated and duplicated many items, including vinyl-mounted drafting papers, arc-bulf power supplies, telescopic alidades, surveying tripods, Wilson photo-alidade telescope, altimeter field test procedure, portable telescopic signal masts, portable field radios, portable electric hammers for setting survey marker tablets in rock, triangulation towers, and induction damped compasses.

Preliminary work is under way on the design of an optical reading telescopic alidade, which will incorporate features of both American and continental surveying instrument practice.

Assistance was given in the design and construction of the following Survey instruments: For the Kelsh plotter, 12 light tables, 2 large-angle pictures, 2 pantograph attachments, 4 pairs of light condensers and power parts, and 15 adjustable legs converted for plotter use; 3 transmission fluorimeters and 2 fluorimeters for solutions; 2 vacuum pulsator pumps and a pulsating air pump; electro-osmosis permameters and surface-sampler permameters; 2 new photoalidades; a counting chamber; 4 discharge integrators; 6 deep-well meters; a polastrodial; 40 Geiger tube assemblies; thermal analysis apparatus; 7 click wheels for micrometer stage; 6 laboratory conductance sets; ratchet arms, gears, and contact plates for a 25-tube Tracerlab automatic sample changer and an aluminum absorber; a drive core sampler; and 3 lap machines.

At present work is under way on a standard design for seven transmission fluorimeters and five ionization chambers, and work is just being completed on 100 meter-foot stadia rods. Conversion of some U.S.E.D. rods to Survey standards is also being completed.

FUNDS

During the fiscal year 1950 obligations were incurred under the direction of the Geological Survey totaling $30,600,500. Of this amount $15,887,012 was appropriated directly to the Geological Survey, and $14,605,411 was made available by other Federal agencies and by States and their political subdivisions.

Obligations incurred by the Geological Survey in fiscal year 1950 (by source of funds)

Topographic surveys and mapping:	
Geological Survey appropriation	$6,382,198
States, counties, and municipalities	1,303,615
Bureau of Reclamation	2,359,251
Department of Commerce:	
Bureau of Public Roads	51,438
Department of Defense:	
Department of the Air Force	551,206
Department of the Army	12,004
Department of the Navy	11,530
Miscellaneous Federal agencies	241,644
Sale to the public of aerial photographs and photographic copies of records	20,608
Total	10,933,494

Geologic and mineral resource surveys and mapping:	
Geology Survey appropriation	$4,070,568
States, counties, and municipalities	86,071
Bureau of Mines	16,308
Bureau of Reclamation	288,497
Department of Defense:	
Department of the Air Force	17,434
Department of the Army	687,797
Department of the Navy	359,627
Department of State	231,127
Atomic Energy Commission	2,495,408
Economic Cooperation Administration	36,501
Miscellaneous Federal agencies	83,735
Foreign governments	34,110
Total	8,407,183
Water resources investigations:	
Geological Survey appropriation	3,933,359
States, counties, and municipalities	2,769,582
Bureau of Indian Affairs	45,259
Bureau of Reclamation	1,391,405
Department of Defense:	
Department of the Army	857,649
Department of the Navy	1,208
Department of State	113,310
American Battle Monuments Commission	3,718
Atomic Energy Commission	214,196
Tennessee Valley Authority	91,601
Miscellaneous Federal agencies	217,003
Permittees and licensees of Federal Power Commission	53,359
Total	9,691,649
Soil and moisture conservation:	
Geological Survey appropriation	35,384
Classification of lands:	
Geological Survey appropriation	320,836
States, counties, and municipalities	486
Bureau of Reclamation	22,285
Miscellaneous Federal agencies	8,851
Total	352,458
Supervision of mining and oil and gas leases:	
Geological Survey appropriation	745,065
Bureau of Indian Affairs	613
Department of Defense:	
Department of the Navy	29,468
Miscellaneous Federal agencies	5,584
Total	780,730

General administration:	
Geological Survey appropriation	$399, 602
Summary:	
Geological Survey appropriation	15, 887, 012
Other Federal agencies	10, 445, 657
States, counties, and municipalities	4, 159, 754
Permittees and licensees of Federal Power Commission	53, 359
Sale to the public of aerial photographs and photographic copies of records	20, 608
Foreign governments	34, 110
Total	30, 600, 500

Oil and Gas Division

Hugh A. Stewart, *Director*[1]

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THE OIL AND GAS DIVISION was established by the Secretary of the Interior on May 6, 1946, pursuant to the suggestion of the President in a letter of May 3, 1946. With a view to the conservation of the Nation's petroleum and gas resources and the achievement of petroleum security, the over-all coordination of the Federal Government's peacetime oil and gas activities was carried on by the Secretary of the Interior with only seven employees on the Division's technical staff.

Advice and assistance on a variety of oil and gas matters and related activities were given daily to the many Federal agencies having responsibilities with respect to oil and gas, or affected by petroleum supply, and to members of the legislative branch of the Federal Government and its congressional committees, as well as to the petroleum and allied industries.

The Division represented the Department of the Interior on interagency committees, which had responsibility in connection with the Government's synthetic rubber program. The Division was also active on a special committee, set up by the Assistant to the President, which studied and reported on the maintenance of the synthetic rubber industry in the United States and disposal of Government-owned synthetic rubber facilities and prepared recommendations for the President, who transmitted them to the Congress of the United States on January 14, 1950.

International affairs brought into focus the significance and importance of petroleum, and the Division advised and assisted the Department of State on numerous matters with respect to United States foreign petroleum policy and problems which necessitated extensive study and work on Department of State committees dealing with foreign oil situations and their effects upon the United States economy and the petroleum industry. The Division participated in more than 30 meetings of one interagency committee, under the chairmanship of the Department of State, which drafted a United States policy on petroleum trade and exchange practices with the British to improve balance of payments equilibrium between the sterling and dollar areas and at the same time to protect the United States world-wide petroleum trade interests. The American companies were assisted in their negotiations with the British Government by informal notes exchanged between the Governments of the United States and the United Kingdom.

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[1] Carroll D. Fentress served as Acting Director during the first 4 months of the fiscal year.

Reports on the present oil resources and development in other countries were prepared and furnished to Federal agencies having need for them.

Intensive study and participation at 102 meetings of Department of Commerce committees dealing with export policy and controls were required to assist that Department on matters concerning export policy and export controls necessary to national security and defense. In June, the Division's representative was a United States delegate on the technical mission held in Paris, France, to discuss export controls of certain equipment.

The Division worked closely with the Munitions Board Petroleum Committee and the National Security Resources Board on petroleum mobilization planning for national security and defense, and was represented on numerous task groups engaged in making special studies. The Division assisted the military, particularly the Armed Services Petroleum Purchasing Agency, on problems with respect to meeting the military requirements for petroleum products.

The Division assisted in planning the petroleum program for the United Nations Scientific Conference on Conservation and Utilization of Natural Resources held at Lake Success, N. Y., August 17 through September 6, 1949, and was officially represented at the Conference.

The Division took part in the work of the American Association of Petroleum Geologists' exhaustive study on the future oil provinces of North America.

To increase the Oil and Gas Division's effectiveness and to keep the public better informed on oil and gas matters, the members of the technical staff testified or were observers at congressional committee hearings, attended important meetings of oil and gas trade associations, and addressed or participated in meetings of various petroleum and mineral industries groups and professional societies.

In the very important task of coordinating the Federal Government's oil and gas activities with the national welfare the Interdepartmental Petroleum Committee, created by the Secretary of the Interior on July 8, 1946, has been most effective. Under the chairmanship of the Director of the Oil and Gas Division, a number of meetings were held during the fiscal year to consider oil and gas matters of national interest, as well as to keep the member agencies currently informed as to the petroleum situation.

Liaison between the Federal Government and the States on petroleum matters was maintained primarily by the Federal Petroleum

Board, under the supervision of the Oil and Gas Division, with State regulatory and conservation agencies, by the official representation of the Director of the Oil and Gas Division on the Interstate Oil Compact Commission, and by direct contacts with State officials. The Department was represented at the compact's annual and quarterly meetings and at meetings of its Economic Advisory Committee and Committee on Regulatory Practices.

At the request of the Secretary of the Interior or the Director of the Oil and Gas Division, the National Petroleum Council studied certain matters presented to it and made reports thereon. During the fiscal year, the most important reports submitted were on the manpower employed in the petroleum industry, Federal oil and gas leasing, petroleum imports, the United States domestic petroleum reserve productive capacity, and a legislative proposal to establish a petroleum policy council. This work required 23 council committees made up of 276 petroleum industry personnel. At the close of the fiscal year, two additional studies were under way; one was the liquefied petroleum gas supply situation, and the other was on the Bureau of Mines' estimates of the cost of producing synthetic liquid fuels. In December 1949, the Secretary of the Interior appointed the individuals to serve on the National Petroleum Council for the 1950 calendar year.

The Secretary of the Interior appointed the Military Petroleum Advisory Board to provide, on a confidential basis, expert counsel, advice, and information on oil and gas matters relating to national security and defense to the Departments of Interior and Defense and to the National Security Resources Board. During the fiscal year, the Board was of especial value in furnishing advice and information on major problems in military petroleum planning for the armed services. More than 200 specialists from the petroleum and allied industries served on the Board's panels and committees, and as staff associates and assistants. At the close of the fiscal year, the Board was functioning under the Order No. 2562 of the Secretary of the Interior, dated April 26, 1950, which superseded Orders 2482 and 2309.

The Connally "Hot Oil" Act (15 U. S. C., 715–7151), which prohibits interstate shipment of oil produced or handled in violation of State law, is administered under supervision of the Oil and Gas Division by the Federal Petroleum Board with headquarters at Kilgore, Tex. The Board consists of a Chairman and member at Kilgore, and an alternate member in charge of the suboffice at Midland, Tex. Suboffices are also located at Houston, Tex., and Lafayette, La.

While the act is applicable wherever State laws limit the rate of production and prescribe conditions for producing and handling oil, its chief application occurs in the States of Texas, Louisiana, and New Mexico where regulations prescribed under the act are actively enforced by the Board and its staff. To a lesser degree, enforcement activities are carried on in the States of Oklahoma, Arkansas, Kansas, Mississippi, and other oil-producing States.

In addition to the 3 Board members, who are active in the field, the staff consists of 24 other individuals: 14 field examiners, and 10 who comprise the accounting, administrative, stenographic, and clerical personnel.

The principal functions of the Board are those of preventing, so far as possible, violations of the act and the application of its sanctions to the more important of the violations that do occur, achieved primarily through continuous field investigations by the examining staff, observing and inspecting producing, transporting, storing, and processing operations and the inspection and auditing of prescribed records and reports, and other records.

From an area designated by published regulation, which includes 106 counties in the State of Texas, two counties in the State of New Mexico, and the entire State of Louisiana, the Board is currently receiving and processing each month some 5,160 monthly operating reports of which about 4,540 are filed by producers, about 543 by transporters, and about 77 by processors and refiners. These reports cover operations carried on in some 841 separate oil fields with about 57,385 producing oil wells, the total average monthly crude oil production from which is slightly more than 50,000,000 barrels. This represents approximately 34 percent of the total crude oil produced monthly in the entire United States.

The enforcement activities by the Board's staff during the fiscal year included the visiting of more than 533 separate oil fields in which 3,446 separate leases were visited and inspected. More than 900 of these leases were fully gauged and checked over continuous periods ranging from a few weeks to several months in length. During the year, operating records of 17 separate pipeline systems, pump stations, and refineries were audited and the physical properties and facilities of these entities were checked and inspected. In carrying on routine field investigations, it was necessary to interview and interrogate some 1,650 different individuals, and in connection with special investigations to determine whether punishable violations of the act had occurred, it was necessary to hold 26 investigative hearings and, in addition, to interview and interrogate 724 other individuals.

At the beginning of the fiscal year, 20 separate cases were pending on the dockets of the Board, 9 of which were undergoing further investigation, 2 were pending administrative review or disposition by the Board, 6 were awaiting the initiation of prosecution by the Department of Justice, 3 were pending disposition in the Federal courts in the State of Louisiana. Investigations were initiated during the year in 11 new cases.

Of the 31 cases thus receiving consideration during the fiscal year, 10 were closed by successful prosecution, pursuant to which fines of $52,950 were imposed and paid, 4 were closed by administrative action without prosecution, and 17 were pending on the dockets of the Board at the close of the year. Of these 17 cases, 4 were pending disposition in the Federal district courts of the States of Louisiana and Texas, 5 were undergoing further investigation, 2 pending review or administrative disposition by the Board, 1 pending review by the Solicitor of the Department of the Interior, and 5 pending the initiation of prosecution by the Department of Justice.

Investigations were completed during the year in 14 cases, 8 of which were pending further investigation at the beginning of the year, and 6 of which were cases opened during the period. Two of the three cases pending in court at the beginning of the year were concluded by successful prosecution, and one remains pending. There were no unsuccessful prosecutions.

In keeping with its established policy, all activities of the Board were carried on in close cooperation with other public authorities, both State and Federal, having related functions, particularly the Railroad Commission of Texas and the Conservation Commission of the State of Louisiana, as well as United States attorneys, the several attorneys general, and taxing authorities having interests touching the subject matter dealt with by the Board.

Office of Land Utilization

Lee Muck, *Assistant to the Secretary*

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ON APRIL 15, 1950, the Office of Land Utilization completed its tenth year as the coordinating agency for the land and resource management activities of the Department. The record of these 10 years indicates that considerable progress has been made by the Department in the fields of forest management, soil- and moisture-conservation operations, and water-resource development. Although the Office has demonstrated the value of effective coordination in the management of natural resources, much remains to be accomplished. Furthermore, as the result of rising international tensions toward the end of the fiscal year, the Office has been engaged in expanding some of its activities in order to assist in the planning for the mobilization of our natural resources. Plans are being prepared for intensifying the protection of our timber resources from fire and for increasing the volume of timber cut from Department of Interior lands by the construction of additional timber-access roads. Bearing in mind the long-range objective of coordinated management, as well as the short-term objective created by the emergency, the Office was at the end of the year undergoing a reorganization to strengthen its land and resource management programs. A discussion of the activities of the Office during the fiscal year 1950 follows:

SOIL AND MOISTURE CONSERVATION

Continued slow but certain progress was made during the year in improving the application of soil-conservation procedures and practices, and in extending the program to additional lands under the jurisdiction of the Department. Measurable progress was also made toward effecting closer and more efficient working relationships between the soil- and moisture-conservation operations and those of other resource management activities of the bureaus, and in the improvement of interbureau and interdepartmental relationships. The most satisfactory progress, however, was made in connection with further development of a realistic pattern of human relationships with the landowners or land users affected by the soil- and moisture-conservation program.

Approximately 80 percent of the land under the jurisdiction of the Department is federally owned, the remaining 20 percent being custodial Indian land. On the federally owned lands under its jurisdiction the Department's legal responsibility for the conservation of the soil and moisture resources is direct and comprehensive. On the Indian lands the conservation problem is more involved. These lands, owned by individual Indians or Indian tribes, are a custodial responsibility of the Federal Government, but soil-conservation operations on any of these lands must be approved by the owners and must be fully integrated with other programs that provide for the general welfare of the Indians. In both instances, however, the human beings dependent upon these lands and resources for their livelihood constitute a conservation potential of tremendous possibilities when directed in the right way. Development of this potential on an effective working basis demands an approach that insures full recognition and appropriate action in connection with both the human and economic problems with which the landowners or users must contend.

On the Indian lands outstanding progress has been made through enlisting the interests of the Indian owners, securing their confidence, and then providing the necessary assistance so that the conservation work may proceed on a sound and satisfactory basis. When the Indian is convinced that this program means being kind to Mother Earth much of his doubt is erased and proper land and resource management not otherwise obtainable is assured.

The users of the public lands in their reactions to the soil- and moisture-conservation program are not so very different from the Indians. The main difference that exists arises largely from the fact that in this case the lands involved are federally owned. However, here again the same objective and the same general approach are bringing increasingly large dividends in the way of action.

Reluctance to participate in the program, or indifference to the practice of conservation, are rapidly giving way and are being replaced by increasing demands for more and more assistance in the way of information and guidance in order that the users of the lands may assist in putting both lands and resources in proper condition. We have been materially aided in all features of the program through the continued development of public realization of the importance of our soil resources to the continued welfare of the Nation, and that each and every landowner and user has a duty to respond in this conservation effort.

FOREST MANAGEMENT

The proper and adequate management of the forests and woodlands under the jurisdiction of the Department has been and continues to be one of the major objectives of the Office of Land Utilization.

During 1950 more adequate protection from forest pests was afforded the forest lands. Four million ribes bushes were destroyed during the calendar year 1949 in the program to protect approximately 650,000 acres of white and sugar pines from the ravages of the white pine blister rust. Likewise, action against the mountain pine beetle infestation in the lodgepole pine forests of western Wyoming and the spruce budworm infestation in Douglas firs in western Oregon was continued in cooperation with the Department of Agriculture. Furthermore, timely and adequate action was taken against many other smaller insect infestations and disease infections.

Of the 441,000,000 acres of forest, brush, grass, marsh and tundra lands of the Department requiring protection from fire, 227,000,000 acres are protected. Of the 214,000,000 acres not protected, 211,000,000 acres are in the Territory of Alaska. During the calendar year 1949, 2,724 fires were reported burning 342,318 acres of federally owned or managed lands. Although this was an increase of 752 fires from the previous year, due largely to lightning, the acreage loss was practically identical for the 2 years with 0.15 percent of the area protected burned over.

The slackening of timber sales reported last year continued through the first quarter of this year. However, increasing demand for lumber, plywood, and pulpwood evident at the midpoint of the year continued unabated at the end of the year. The record shows that for the entire year the forests of the Department produced 1,116,009,000 board feet of timber valued at $10,557,521.

The ultimate goal of adequate protection from fire, insects, and disease which is basic to complete management has not yet been achieved. According to the 1950 evaluation, by the bureaus concerned, of the protection from fire afforded the Department's lands in the continental United States, 24 percent of the area has excellent protection, 69 percent good protection, 4 percent fair protection, 2 percent poor protection, and 1 percent no protection. Furthermore, the detection of incipient forest insect infestations has not evolved to an adequate basis as yet. The Department's progress has been steady but it should be understood that intensive management of our forest lands has yet to be accomplished.

LAND CLASSIFICATION AND LAND POLICY

Review of proposed land transfers, land withdrawals, land disposal, and similar actions requiring secretarial action involved the examination of about 900 documents. Recommendations were made to the Solicitor concerning action on 54 appeals from decisions of the Bureau of Land Management rejecting applications for entry on public land, where the rejections were based on determinations by the bureau that the land was unsuitable for the purposes for which applications for entry were made.

A field investigation was made of the progress of land classification activities in the regional offices of the Bureau of Land Management since the decentralization of these activities was initiated in 1948.

The Director of Land Classification represented the Secretary of the Interior on the 1951 Yearbook Commission of the American Association of School Administrators, an affiliate of the National Education Association, which is planning to devote its 1951 yearbook to the subject of teaching conservation of natural resources in primary and secondary schools.

The Office of Land Utilization has been represented on a task force established by the Bureau of the Budget to study land-management functions of the Federal Government in view of disagreement within the Committee on Organization of the Executive Branch of the Government. The task force consists of two representatives each from the Bureau of the Budget, the Department of Agriculture, and the Department of the Interior. It is concerned especially with disagreement within the Hoover Commission as to whether a combined Forest and Range Service consisting of the Forest Service and portions of the Bureau of Land Management should be placed in the Department of Agriculture or the Department of the Interior. The task force is studying the organization and activities of the two bureaus concerned, their interrelationships and their relations with other land-managing agencies, and the relationships of Government land-management functions to private citizens, particularly the users of the public lands.

WATER RESOURCES COORDINATION

During the year, agencies of the Department, acting through the Water Resources Subcommittee, reviewed 35 river and harbor and flood-control reports of the Corps of Engineers, Department of the Army, concerned primarily with flood control and navigation; and 3 basin and project reports of the Bureau of Reclamation concerned principally with irrigation. Proposed projects by both agencies also have incidental power, flood-control, and water-conservation benefits. The agencies also reviewed 48 applications for power permits and licenses referred to the Department by the Federal Power Commission. Recommendations were formulated for all projects designed to protect the varied interests of the agencies of the Department, and to assure, so far as compatible with the primary purpose of the proposed projects, that in their design, construction, and operation, appropriate consideration would be given to all uses of water.

The executive officer of the Water Resources Subcommittee acted as alternate to the Department's representative on the Federal Inter-Agency River Basin Committee, and liaison with the Bureau of the Budget and the President's Water Resources Policy Commission on matters relating to basic data programs. Agencies were kept advised throughout the year of action by the Federal Inter-Agency River Basin Committee, its three field committees (Missouri Basin Field Committee, Columbia Basin Inter-Agency Committee, Pacific Southwest Technical Committee), and its technical subcommittees (hydrologic data, sedimentation, and benefits and costs), and other interagency working groups, in order that agencies of the Department might actively participate in these technical coordination activities in which they are especially interested.

In connection with departmental operations, the agencies represented on the Water Resources Subcommittee were given full opportunity to review programs prepared at regional level by the Department's field committees, and also to participate in the formulation of interstate water compacts through the designated Federal representatives.

Bureau of Land Management

Marion Clawson, *Director*

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TO MEET THE DEMANDS of an expanding economy, the Bureau of Land Management during the past year increased its activities manyfold in the administration of some 500 million acres of public lands in the United States and in Alaska. Basic resource development and management work of this agency has helped the country grow industrially at the same time that such activity has safeguarded the interests of this and future generations of Americans.

In the fulfillment of its responsibilities, such as the administration of mining, timber, and grazing lands, the Bureau of Land Management has achieved considerable stature as one of Uncle Sam's conservation-minded money makers.

Receipts during the 4 years since the Bureau of Land Management was formed by the consolidation of the General Land Office and Grazing Service of the Department of the Interior, have totaled approximately $125 million. Of this amount, more than 50 million dollars were transferred to the Bureau of Reclamation for investment in dams and other projects for the development of the West. Almost 50 million were paid to States and counties for use for schools, roads, and other local purposes. Part of the remainder of this amount was used for conservation developments and the rest was placed in the miscellaneous receipts funds of the Treasury.

In addition to being one of Uncle Sam's money makers, the Bureau of Land Management also provides services relating to the public domain in supplying information on titles, as well as disposing of tracts of land under homesteading, mining, and other land laws, and making cadastral surveys.

During the past year, the Bureau of Land Management has assumed an even more important role in western and national economy as shown in the greater number of applications for use of the public land. Applications have increased from a total of 17,000 during the fiscal year, 1946, to a total of 34,000 during the fiscal year, 1950.

Mineral leases, leases, and sales of tracts of 5 acres or less for use as business and recreational sites, homesteads, desert-land entries, exchange of land with States, withdrawals, and reservations requested by military and other agencies, are major types of land-office cases.

In addition to its job as a real-estate agency for the Government, the Bureau of Land Management has definite responsibilities to protect and to increase the productivity of the lands under its jurisdiction. During the past year, this agency has moved forward on an accelerated program of rehabilitation of range lands and forest conservation, and other related work. A Bureau of Land Management program designed to expedite cadastral engineering surveys on public lands, to microfilm valuable land-office records, safeguarding them against possible loss, and to provide a continued economic efficient operation of selective disposal, development, and use of the people's acres, is being forwarded as funds are made available.

A review of the reports from the seven regions of the Bureau of Land Management, extending from Alaska to California and embracing 29 States and 1 Territory, presents a good economic cross section of American progress and potentialities. 8,576,859 head of livestock grazing on grazing districts administered by the Bureau of Land Management reflects the importance of the western livestock industry and its impact on the national economy. $4,947,813 worth of timber, containing a volume of 413,403,000 board feet, was marketed on O and C lands in western Oregon, emphasizing the value of the sustained yield policy on these lands. Revenues from oil and gas, phosphate, potash, and other mineral leases exceeded $29,000,000 and show the increasing interest in these activities, basic to national security and national agricultural and industrial prosperity.

Although its many activities are and will continue to be centered in this country, the Bureau of Land Management has received international recognition this year in requests for technical assistance on land problems in Guam and Pakistan and in representation at engineering conferences in New Zealand. In line with the President's point 4 program, this agency is making available the use of its experts, when funds are provided to make this service possible.

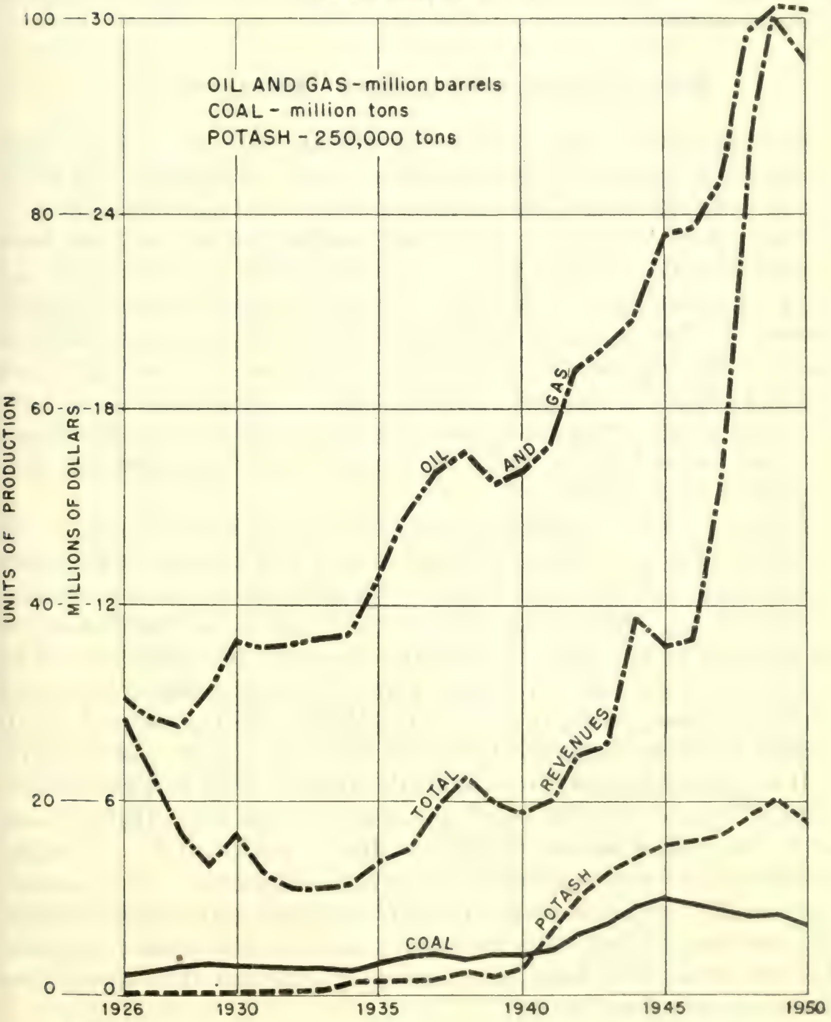
Cooperating with other Federal agencies, the Bureau of Land Management has taken the initiative this past year in several important land planning studies, including those for Alaskan development, the drafting of legislation to modernize the land laws, in aiding veteran settlement, and in seeking by experimentation vegetation best suited to the rehabilitation of western range lands. Fully cognizant of the need for economy, the Bureau of Land Management has geared its administrative machinery to drive forward with a program that can best serve the public interests.

INCREASED PUBLIC LAND USE

After more than 150 years of an active campaign to dispose of its public lands, the United States, in 1934, changed over to a policy primarily of use and selective disposal with respect to the surface but still adhering to the policy of disposal as to any minerals in the land.

Although approximately three-fourths of the original public domain outside of Alaska has been disposed of, approximately 412 million acres, plus 45 million acres of acquired lands will bring more revenue to the Federal Government than has been realized up to now. These revenues will come from several sources, but a principal source will be those mineral deposits which are subject to lease. These include, coal, oil, gas, oil shale, potash, phosphate, sodium, and, within certain limitations, sulfur. The following chart shows the mineral production under lease of public-domain lands.

MINERAL PRODUCTION UNDER LEASE OF PUBLIC DOMAIN LANDS
1926 to 1950



Mineral Deposits on Public Land

A substantial percentage of the three trillion tons of known coal deposits is in the public lands and an unknown quantity of oil and gas exist there. At present only about 4 percent of the total production of oil and gas comes from public lands. The use of oil and gas has increased immensely in the past 20 years so that, although new discoveries have multiplied at least in the second half of that period, the proven reserve suply is sufficient only for 10 to 15 years.

The remaining public land, including acquired land and the intermingled privately owned lands, offers one of the best, if not the best, areas for prospecting for more oil and gas. Rapidly increasing technical knowledge has made it possible to find oil where no surface evidence exists.

Record Shows Increased Development

Comparatively recent discoveries indicate that oil and gas may be found in quantity in the public land area of the West. This is graphically reflected in the statistics of the Bureau for fiscal 1950.

These show a total of 16,000 non-competetive oil and gas lease applications filed during the year. These figures compare with the filing of about 7,000 oil and gas prospecting applications annually during the first few years after the mineral leasing act of 1920 was passed. During the 1930's applications dropped to about 2,000 per year. During the war years, about 4,000 lease applications per year was the average. Spurred by the need for oil after the war this figure rose to around 7,000 in 1947. It is now more than twice that and appears to be on the rise.

Leases in large numbers are being sought in States where no oil or little oil has been found. In Utah, a State which formerly produced only a token amount of oil and gas, this activity has already resulted in discoveries. Knowledge recently acquired as to distribution of oil and gas in the earth has resulted in giving prospective value to areas in the public-land States formerly condemned or accorded slight attention. Similar areas in the Middle West, East, and South include lands purchased by the United States during the past 20 years.

It is impossible either to estimate the amount of oil and gas remaining undiscovered in the public lands or to make more than a guess as to the rate of new discoveries in future years. It can be safely assumed that for a long time to come prospecting activity will increase and broaden in scope because (1) the older oil fields are being depleted, (2) the demand for oil is increasing, and (3) the areas containing Federal lands have been less thoroughly explored than most other potential oil and gas areas.

Potash and Phosphate—Fundamental to Agricultural Economy

The continued production of potash and phosphate is essential to all life. As populations increase, the drain of these minerals from land devoted to agriculture and stock raising becomes greater. Nearly all known potash deposits are in public lands and those lands include most of the potential potash areas. More than half of the known presently usable phosphate deposits are in public lands. This Bureau is active in endeavoring to further the search for new minable deposits of these minerals and their utilization in restoring the rapidly depleting soils upon which the Nation depends for food and clothing. Two important new discoveries of potash were made in New Mexico on Federal prospecting permits during fiscal 1950 and substantial progress was made in a program designed to accelerate the development under lease of the public-owned phosphate deposits.

Adverting again to fuel minerals, experiments now being conducted by the Bureau of Mines may result in the start of a private industry in the production of oil from oil shale of which the public lands may well contain enough to produce upward of one trillion barrels of oil. When such an industry will begin depends largely on the relative costs of producing extracted oil and on the ability to find new sources of oil. More oil will be found in pools than has been found but it must be remembered that much, much more is needed now than was required a decade ago. When the time comes to look elsewhere for oil the oil shale, and coal, and oil sands all of which are situated in large amounts in the public lands, will have to be mined to supply continuing and increasing demands.

Selective Disposal Policy

Although the policy of Government with respect to the public lands is primarily one of use, laws providing for the disposal of lands are still in force and still operate on lands classified as suitable for disposal. Since little agricultural land is now in public ownership, disposals of lands for farming are limited to occasional tracts which are susceptible to such use. The hunger for land still persists, however, and the Bureau's offices are continually besieged by veterans and others who are willing to undergo the hardships of the pioneer in order to obtain a home. Many requests must necessarily be denied. There is no longer plenty of land for everyone. However, the wants of many—those who are content to receive a home site, or a place to go for recreation—are being satisfied. Large areas of public lands are being made available in tracts from 1 to 5 acres, in Florida, California, Arizona, and elsewhere, and many thousands are taking advantage of the opportunity thus provided. World War II veterans are given preference rights to secure these lands.

The Taylor Grazing Act of 1934 which provided for the classification of public lands also provided for exchanges of lands with private owners and with States. By utilizing this provision, the Bureau has been able to block up areas of land under its administration. States are able to an extent to consolidate their holdings, previously scattered as single sections over nearly every township in the State and the livestock and other industries of the public-land States have benefited through consolidation of holdings.

Speeding Up Action on All Cases

In general, decentralization and improved procedures have resulted in a speeding up of the work of acting on public-land cases. The chart on page — shows number of cases closed this year.

Basic to all land use is the work of this agency's engineers.

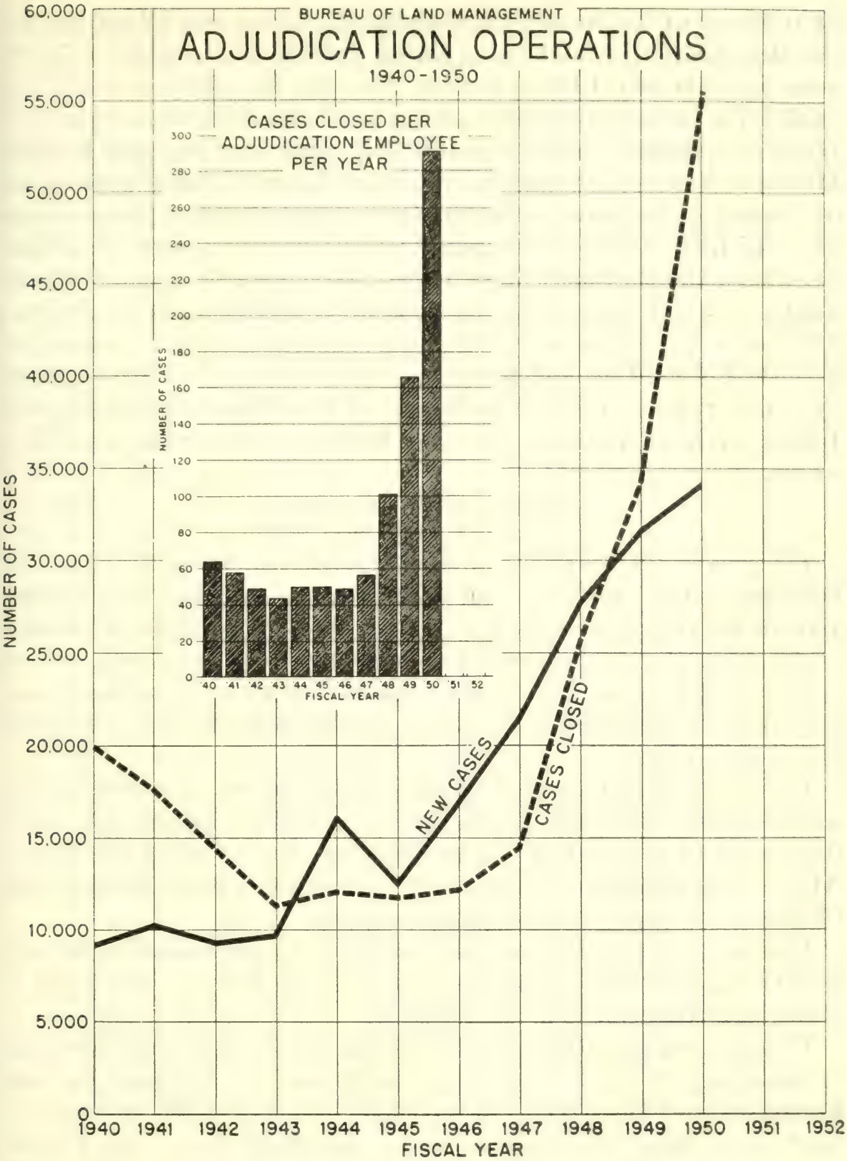
CADASTRAL SURVEYS BASIC TO RESOURCE DEVELOPMENT

The basic information obtained in a cadastral survey is a necessity to any major project initiated on the public lands. These surveys create land boundaries, identify the lands, determine areas, furnish legal descriptions for title purposes, and actually mark the lines on the ground by establishing substantial monuments.

Surveys in the Continental United States

Title to about 50 percent of the area of the 11 Western States is still in the Government. Approximately 100 million acres of this area—equivalent to 15 percent of the total area of those States—have not been surveyed. The value and future need of timber and the potential mineral deposits in the unsurveyed areas constitute one of the primary needs for the completion of the original surveys. In addition, at the present time there is an actual demand for the resurvey of over 50 million acres located in the Western States which were surveyed many years ago.

Surveys and resurveys are needed for grazing administration—reseeding, fencing, soil-conservation work; for control of mapping programs; for the identification of lands leased under the oil and gas act; for the development of river basins; for the management of the O and C lands and the public lands in national forests; for the administration of the Small Tract Act passed in 1938; for the settlement of



trespass cases; for the survey of lands erroneously omitted from the original surveys; for the survey of islands and areas formed by accretion, etc.

Due to the lack of funds, the Bureau of Land Management has not been able to keep current with the demand for surveys and it has been possible to undertake and complete only the most important projects.

The major projects completed during the year included the survey or resurvey of 55,780 acres in California, Idaho, and Wyoming for the identification of land leased for oil and gas or phosphate; 472,388 acres in Colorado, Idaho, Nevada, New Mexico, Oregon, and Utah needed for the administration of the public lands in connection with range-management activities; 1,234,927 acres in Colorado, Kansas, Montana, Nebraska, North Dakota, South Dakota, and Wyoming for the Bureau of Reclamation in connection with the development of the Missouri River Basin; 28,220 acres in California necessary for administration under the Small Tract Act; 47,360 acres in Oregon and Washington national forests; 23,040 acres of O and C lands in Oregon; 9,445 acres in California for Department of the Army in connection with the Folsom Dam and Reservoir; 8,320 acres in Arizona requested by settlers; and survey of islands omitted from the original surveys in Idaho, Nevada, Alabama, Florida, Michigan, Minnesota, and Wisconsin.

Surveys in Alaska

The area of the Territory of Alaska is 365,481,600 acres. The rectangular system of surveys has been extended over only 2½ million acres or less than 1 percent of the total area. Although the entire area of Alaska never will be brought under the rectangular system of surveys, it will be necessary to keep a substantial force of engineers employed in the Territory to make the surveys necessary for settlement and development.

There is an urgent need and demand for the survey of isolated tracts, such as home sites, homesteads, trade and manufacturing sites, etc.; the survey of town sites; and rectangular surveys along the Glenn, Alaska, and Richardson Highways and in the Chena, Haines, and Chilkat Lake areas for settlement purposes.

The cadastral engineering program should be accelerated materially in Alaska, as at the present rate of progress delay in surveying is retarding settlement and development.

The most urgent projects completed during the fiscal year consisted of the survey of 47,830 acres along the Richardson Highway between Fairbanks and Big Delta for settlement purposes; the resurvey of 2,220 acres being administered under the Small Tract Act located along the Glenn Highway and in the vicinity of Anchorage; 194 individual tracts scattered throughout the Territory for home sites, headquarters sites, homesteads, trade and manufacturing sites; and for exchange purposes; and 441 lots in the town sites of Sitka, Cordova, Kenai, Kodiak, and Fort Yukon.

Century old land office records including engineering surveys maintained by the Bureau are priceless tools and their preservation is essential to millions of peoples all over the country.

PRESERVING AND MODERNIZING LAND OFFICE RECORDS

The problem of preserving as well as modernizing the Bureau's public land record system; both in Washington and the field offices, continues to be a matter of great concern to the Bureau since the loss of these records by fire or other disaster, would have a far-reaching effect on future business transactions of both public and private enterprise.

The Microfilm Project

During the year preliminary plans and procedures were developed for a comprehensive revision of the basic land record system. A small start was made with a $10,000 appropriation on one phase of this modernization program. The job of microfilming 6,500,000 patents contained in 11,550 volumes was begun in February. As of June 30, 573,000 patents were microfilmed on 35 millimeter film. When completed, the project, it is estimated, will pay for itself in approximately 5 years in savings on office space and maintenance costs alone. The life of the patent record will be extended indefinitely by use of this process.

The Records Inventory

In cooperation with the National Archives, substantial progress was made on a general survey or inventory of the records contained in the Bureau's files. This survey should be completed in the fiscal year 1951 and will be used as a basis to carry out a systematic records retirement program.

OTHER ADMINISTRATIVE IMPROVEMENTS

Part of the administrative machinery of any agency is the handling of supplies on an economical expeditious basis.

The fiscal year 1950 accomplishments produced many improvements both in Washington and field procurement and purchase of equipment and supplies, space utilization, property control, distribution of printed material, and communication services.

Regional purchasing of office supplies and equipment through local Federal supply centers and schedules have saved considerable money in shipping costs and time.

Major improvements were also made in the accounts work.

Following decentralization of the accounts receivable to the regional offices, studies were conducted as a result of which pilot installations were made to further decentralize the maintenance of the accounts and collections of revenue to the district level. The results justified the extension of the plan to all district offices.

An internal audit staff was established and completed the reconstruction of the accounts receivable in three regions and the producing oil and gas accounts in another region.

The Bureau participated actively in the initial presentation of performance-type budget.

Improved Management

A land office organizational pattern has been developed as a guide, taking into consideration the physical lay-out, mechanical equipment, flow of work, personnel utilization, and related factors. This pattern is now being followed with some few minor exceptions in Cheyenne and Billings. It is being adopted as circumstances permit in other land offices.

Recommendations have been made for revision of the present oil and gas lease regulations and procedures, small tract lease and sale regulations and procedures, and the section 15 grazing lease. All of these recommendations embody the idea of a combined application and lease form which greatly simplifies the work of the Bureau. The changes should facilitate the handling of applications in several ways. The new oil and gas lease procedure will discourage filings which are not bonafide. In most cases such filings do not result in the issuance of a lease.

New procedures will greatly simplify the accounting work as the funds will be earned immediately and the making of refunds should be reduced to a minimum.

An organization chart of the Bureau is shown on page 244.

In accordance with the memorandum of the Secretary, dated February 28, 1950, and Order No. 2556 of the same date, a comprehensive management improvement plan was prepared and submitted to the Secretary which he approved. This calls for the survey of each of the Bureau's functional areas every 3 years. Plans are now under way to make the first survey of the adjudication function.

Bureau Suggestions Committee Report

During the fiscal year 1950 the Bureau suggestions committee considered 173 suggestions. Final report was made on 118, and 55 were still pending at the end of the year. Of the 118 on which final report was made the suggestion was adopted and award made in 21 cases, or 18 percent. Awards amounted to $450, an average of $21 per award.

The suggestions for the most part dealt with changes in methods and procedures, some of them affecting every office in the Bureau, resulting in increased efficiency. The monetary savings represented by man-hours, increased revenues to the Government, and savings in supplies and equipment, amounted to approximately $10,000.

AGENCY AVERAGES 1,200 EMPLOYEES

The average employment of all types of employees except district grazing advisers, was 1,200. Average employment in the Washington office was 204 and in the regions as follows: Region 1—250, region 2—143, region 3—197, region 4—175, region 5—133, region 6—15, region 7—83.

A very effective program to orient employees and keep them informed of Bureau operations was carried through during the year.

Under the honor awards system, two awards were made for distinguished service, 10 for meritorious, and 10 for commendable. Eight pay increases for superior accomplishments were earned by Bureau employees.

One for the basic responsibilities of the Bureau of Land Management is that of range management.

FEDERAL RANGE VITAL IN NATIONAL ECONOMY

The Federal range shoulders an important economic role in our expanding national development. Population increases and continuing improvement in living standards result in heavier demands for meat, wool, leather, and other animal products. Production levels to meet the expected and rapidly materializing demands are not possible without greater attention to technology and active managment of available and potential resources. Industrial expansion in the western States and population shifts to the west coast during and following World War II have tended to increase the pressure on the western ranges.

Although the demand for grazing is expanding, developments progressively decrease the area available for that purpose. Improved farm management, including crop rotation on irrigated lands, and acknowledgment of the value of livestock in maintaining soil fertility and water-retention capacity through humus-mineral relationships, result in larger demand for range use during the tillage season. At the same time, greater public interest has been focused on the present inadequacies for protection against fire, trespass, erosion, rodents, insects, and disease, which are responsible for extensive waste and damage.

Progress in the administration of grazing upon the public lands is noted by gradual increases in production capability. During the year, emphasis has been placed on reducing overuse or unseasonable use, preventing trespass, making seasonal adjustments needed as a result of weather and rainfall fluctuation, and initiating corrective treatment measures on depleted ranges.

Various other uses of the public lands command attention, including watershed values, timber and wood products, wildlife and recreational uses, all of which are highly important. The Bureau objective is to promote the highest combined land uses on every ranch or other operating unit in keeping with the highest possible sustained yield of the renewable resources. This is possible only through continued decentralized management of the lands and consultation with local advisory boards to correlate the livestock and wildlife grazing requirements with each other, and with each of the remaining important land uses. Specifically, the objectives are: (1) to use the land in a manner which will insure continued and permanent optimum productivity and value; (2) to promote the highest sustained use in accordance with land capability; (3) to reduce erosion, siltation, and flood damage; and (4) to restore lands damaged by fire and cover depletion.

It has become increasingly evident that grazing capacity estimates, especially in areas subject to highly variable precipitation, are of limited usefulness other than as an indication of what the long-run average expectancy might be. It is necessary to correlate the rate of stocking in accordance with seasonal forage production. Periodic range inspections are needed. This is particularly important in the Southwest where seasonal drought conditions often force heavy supplemental feeding or removal of the livestock, and where such drought conditions may alternate with seasons of above-average rainfall.

A pilot study of progress in range management has been initiated in the grazing districts of one region to establish a method for determining the effectiveness of grazing control under the Taylor Grazing Act. Balance between seasonal demands and trends in forage cover are important problems in the study.

GRAZING ADMINISTRATION

The livestock industry supplies the meat and meat byproducts so vital in our Nation's expanding economy. The public lands of the west contribute in a major degree to the total forage requirements of the range livestock portion of the industry. The new high value of every grazing animal has created additional interest among stockmen in finding and using good pasture.

The grazing district ranges have improved in all areas where the permittees have held to the limits of authorized use. Many localities have been noted where healthy perennial vegetation is covering areas that have been barren for several years. For example, in Colorado grazing district No. 1, there is reported "native grass suitable for mowing on township after township of winter grazing land which formerly was occupied by browse plants which were hedged and some of which were in dying condition." In too many areas, progress has been slow because of inadequate field personnel for effective supervision.

For the most part, better forage conditions have been noted this year in the Northwest because of heavier than average snowfall and favorable spring rains. The Southwest has suffered widespread winter and spring drought conditions with consequent heavy supplemental feeding and reductions in livestock on the range. Many operators there have moved to private irrigated pastures and have requested nonuse or partial nonuse of their allotments.

The effectiveness of conservative use of the forage resources is more outstanding on certain range units where there has been close, joint study and husbandry by the users, range managers, and district advisory boards. Increased attention is being directed to adjustments needed to control grazing to reasonable limits in seriously crowded and depleted areas, and in keeping with seasonal forage condition fluctuations.

A tighter grip has been taken on grazing trespass, but the number of present supervisory personnel is inadequate to prevent it. Good response has been experienced in many instances as a result of warnings without requiring formal action. However, it has been necessary to press charges in numerous cases of direct violation, repeated misuse, and occasionally for negligence.

Range surveys have been severely restricted by manpower shortages. Spot studies of grazing capacities and dependent base property qualifications have been made in connection with grazing appeals and transfers of grazing privileges to provide data on properties and range.

The grazing district advisory boards have continued in their important function of recommending actions to be taken in connection with fitting the demand for grazing privileges into the forage resources available and adjusting operations to more nearly conform to desirable range conservation practices. The regulations were amended to provide for State advisory boards and a National Advisory Board Council to consider and make recommendations on grazing administration policies or problems affecting the States and the Nation, respectively. These boards have been active previously, but only with administrative sanction.

Several grazing district boundary adjustments have been made to effect more economical administration. The more important of these include the transfer of the so-called Ramah unit comprising about 10 townships, to New Mexico grazing district No. 1, and the transfer of the so-called Puertocito unit comprising about 3 townships, to New Mexico grazing district No. 2. Another major adjustment was the consolidation of the west half of Oregon grazing district No. 2 with Oregon grazing district No. 1.

The operations of 20,887 grazing district licensees and permittees were covered by authorizations for 8,576,859 head of livestock as follows: 2,237,477 cattle, 83,100 horses, 6,229,189 sheep, and 27,093 goats. About 10,426 of the operators have 10-year grazing permits.

On vacant public lands outside of grazing districts leases are issued to livestock operators in accordance with section 15 of the Taylor Grazing Act. One of the results of decentralizing this function to the district level for action is a substantial increase in the acreage placed under lease. By and large, each additional lease issued reduces trespass on the lands involved. Limited personnel is reflected in minimum application of proper range management and conservation practices on these lands.

On June 30, 1950, there were 11,010 grazing leases in force on more than 13,000,000 acres of public lands, an increase of about 900,000 acres, and leaving a balance of about 22,000,000 acres yet available for lease. Of course the balance includes some lands that are barren or otherwise not suitable for economic grazing.

INTERRELATIONSHIPS

Proper management of the public lands is prerequisite to regional and industrial stability which in turn is essential to the Nation's expanding economy. The complexity of the land pattern throughout the public-land States indicates the multiplicity of interests, and reflects the confusion in jurisdictional responsibilities among Federal, State, and other agencies. Correlation is needed within each drainage basin in order to avoid conflicts in objectives and to minimize duplication. Cooperative agreements have been widely used as tools with which to coordinate interagency interests in resource management.

During the year various amendments have been made to the lists of reclamation-withdrawn lands placed under the jurisdiction of the Bureau for grazing-use regulation pending use of the land for actual irrigation development. For example, the lands withdrawn for the Hassayampa project in Arizona were placed under administration while certain lands in the Minidoka project in Idaho were released from the agreement.

Cooperation with State, county, and private agencies is a necessary part of area resource management. Land-pattern control actions, involving land exchanges and leases by the Federal Government pursuant to the Pierce Act, are continuing problems that require close working relationships.

An example is a memorandum of understanding executed with the Atomic Energy Commission by which the Bureau will administer the grazing use on the recently established 400,000-acre research station in Idaho grazing district No. 3 until the area or any particular part of it is actually put to research use.

RANGE STUDIES

Through cooperative agreements, studies are being made of range-management problems throughout the West. Of greatest importance to the Bureau is the work being done at the Squaw Butte-Harney Range and Livestock Experiment Station in Oregon, which is financed and operated jointly by the Bureau and the Oregon Agricultural Experiment Station.

Phases of the station program carried through the year include range studies on rotation-deferred grazing compared with season-long grazing, control of Mediterranean sage and big sage, and forage inventory, and range-utilization measurement. The livestock-management studies include winter nutrition requirements for breeding cows, larkspur poisoning, rate of calf growth in relation to cow size, factors influencing growing out replacement heifers, and cross-breeding Brahman and Hereford cattle.

The range studies at this station are the responsibility of the Bureau; the livestock studies are the responsibility of the agricultural experiment station.

Range studies are being made on public lands in cooperation with various agencies, such as the State agricultural colleges and experiment stations, and Forest Service experiment stations, on such matters as reseeding, weed, brush and pest controls, and flood control. The study of resource-management problems on the ground where corrective practices must be put into effect are extremely helpful in the whole field of resource conservation.

WILDLIFE MANAGEMENT

The Bureau has continued to participate actively in game management with the State game departments. Range managers and wildlife representatives on the district advisory boards serve an important function in recommendations upon annual game harvests, game transplants, and similar basic wildlife management planning.

In many areas, the deer herds have expanded beyond previously anticipated numbers, due in part to predator control, improved habitat, water developments, forage conditions, and to the general population upswing during and immediately following World War II. Some State game departments are participating financially and otherwise in reseeding Federal range to provide additional forage supplies for both domestic livestock and big game to reduce competition. By increasing the grass yields, the livestock use less browse which is the natural forage for deer.

RANGE IMPROVEMENTS

The facilities for proper range use are so meager that constant effort is made by the Bureau and the stockmen to improve the range so that the livestock can be grazed according to sound management practices. Water developments and division fences continue as the two most needed types of improvements to facilitate the distribution of livestock so as to insure proper distribution and utilization. Many areas are still inadequately watered. An active maintenance program has been carried on, both by the Bureau and by individual permittees who keep in repair and operate a great number of Government-owned structures, pursuant to cooperative maintenance agreements.

The stockmen's interest in range improvements is reflected in the contributions made to the improvement program. Annual reports from three regions indicate $633,594 in contributions compared with $151,299 available from appropriations during the year.

SOIL AND MOISTURE CONSERVATION OPERATION

The increasing demand for usable water by an expanding population has served to point the soil and moisture program of the Bureau of Land Management more and more toward a program of watershed management. It is estimated that the public-domain lands produce 400,000,000 tons of silt annually. While producing this tremendous volume of silt, these same lands provide roughly only 12 percent of the usable water supply. The purpose of the soil and moisture program is to reduce this tremendous flow of silt and increase the production of usable water. The size of the job is indicated in the following table which shows the acreage of Bureau of Land Management lands contained in the major drainage basins in the West.

Basin	Total area	BLM lands	Percentage
	Millions of acres	*Millions of acres*	
Colorado	155	52	33⅓
Columbia	160	24	15
Great Basin	130	76	58
Rio Grande	77	12	16
Missouri	333	18	5½

In many cases BLM lands constitute as much as 85 percent of the watershed of tributaries to these large rivers.

It has been estimated that 50 percent of the 190,000,000 acres administered by the Bureau are in a state of severe to critical erosion, while 32 percent are moderately eroded, and only 18 percent are in a condition of slight to no erosion. The rehabilitation of these eroded lands is of primary importance in effecting a reduction in destructive silt flow, an increase in usable water supply and the preservation, protection, and enhancement of the economy of the country. The recognition of these is indicated by the increasing voluntary contributions to this program by private individuals and organizations. In the first half of the fiscal year, the contribution amounted to 35 percent of the total funds expended by the Bureau, an increase in rate of 6 percent over last year.

Much has been done to rehabilitate many of the more depleted public lands, but there still remains a tremendous job ahead. Of 50,000,000 acres of public lands contained in approved project areas, only 17,000,000 have received any conservation treatment, leaving 33,000,000 acres in approved project areas yet to be treated, plus 106,000,000 acres of depleted lands outside of project areas in need of treatment.

Recognizing the tremendous conservation job the Bureau has taken steps to develop a more realistic and comprehensive soil and moisture program. The most important of these steps will be the closer correlation of its program with other conservation programs, with more attention to watershed management and river-basin development. Next in importance is to manage the renewable resources on these lands on a sustained-yield basis; finally, acceleration of conservation education of the land users.

RANGE REVEGETATION

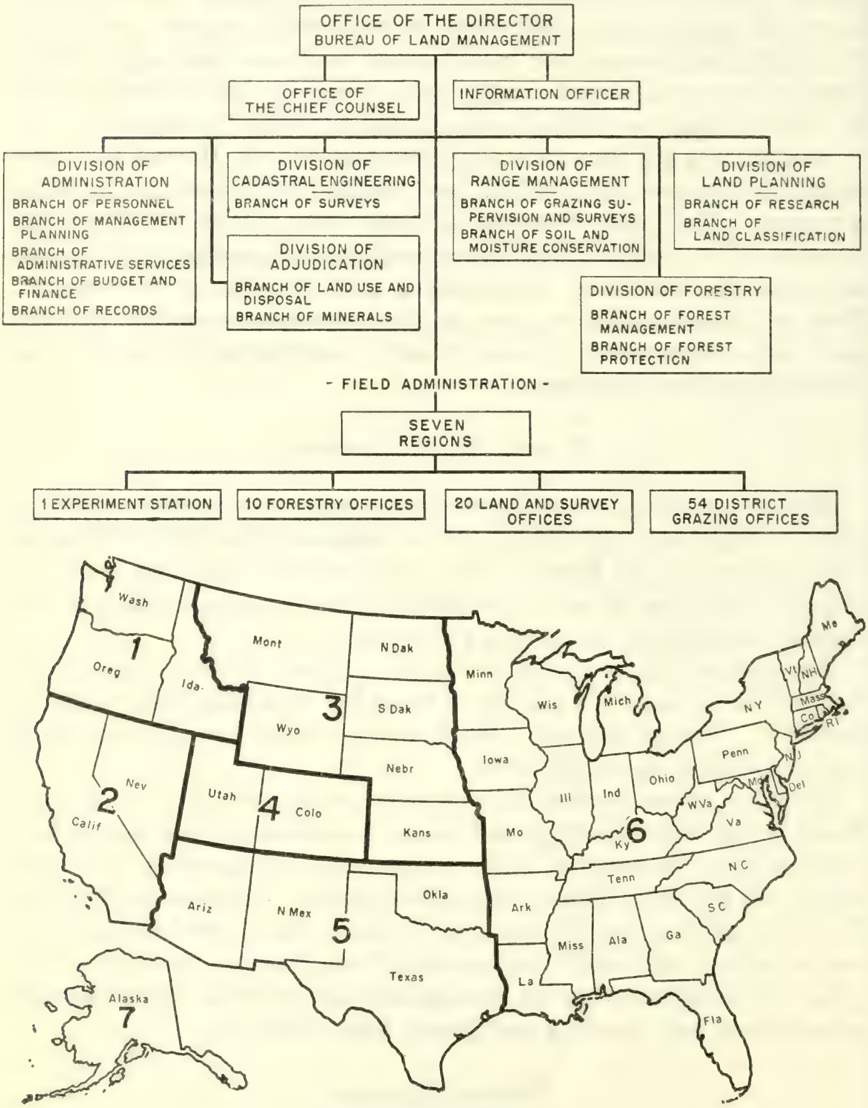
Range vegetation is playing a more important part in the rehabilitation of depleted range lands. It is estimated that 22,000,000 acres administered by the Bureau are in need of reseeding and brush removal. The value of range revegetation lies in increased forage production and greater watershed protection.

The revegetation program of the Bureau during the fiscal year 1950 was increased somewhat in spite of the delay in passing the appropriation bill. During the year, 46,039 acres were reseeded while brush was removed from 32,029 acres.

Plans have been formulated to accelerate the revegetation program. Recognizing that securing seed on an uncertain market would be a problem, the Bureau has made cooperative arrangements with the Army and the Navy to harvest seed from Lowry Air Base and Buckley Field Naval Training Station near Denver, Colo.; 160,000 pounds of crested wheat grass seed was harvested from Buckley Field alone this year. It is expected that the Bureau will harvest about 250,000 pounds of seed from both Buckley and Lowry fields next year.

WEED CONTROL

A recent survey indicates that there is a widespread infestation of the poisonous plant, halogeton, on range lands mostly in the States of Idaho, Nevada, and Utah. The growing demand for weed control on the public lands would indicate the need for a realistic long-range program. State and county weed-control programs have been initiated in some areas but, because of lack of funds for this activity, the Bureau has not been able to cooperate in these programs to the degree the situation demands. Studies are being made to devise economic means of eradication by cultivation methods, reseeding to grasses, and by the use of herbicides.


OFFICE OF THE DIRECTOR
BUREAU OF LAND MANAGEMENT
OFFICE OF THE CHIEF COUNSEL
INFORMATION OFFICER
DIVISION OF ADMINISTRATION
BRANCH OF PERSONNEL
BRANCH OF MANAGEMENT PLANNING
BRANCH OF ADMINISTRATIVE SERVICES
BRANCH OF BUDGET AND FINANCE
BRANCH OF RECORDS
DIVISION OF CADASTRAL ENGINEERING
BRANCH OF SURVEYS
DIVISION OF ADJUDICATION
BRANCH OF LAND USE AND DISPOSAL
BRANCH OF MINERALS
DIVISION OF RANGE MANAGEMENT
BRANCH OF GRAZING SUPERVISION AND SURVEYS
BRANCH OF SOIL AND MOISTURE CONSERVATION
DIVISION OF LAND PLANNING
BRANCH OF RESEARCH
BRANCH OF LAND CLASSIFICATION
DIVISION OF FORESTRY
BRANCH OF FOREST MANAGEMENT
BRANCH OF FOREST PROTECTION
- FIELD ADMINISTRATION -
SEVEN REGIONS
1 EXPERIMENT STATION
10 FORESTRY OFFICES
20 LAND AND SURVEY OFFICES
54 DISTRICT GRAZING OFFICES
Wash
1
Oreg
Ida
Mont
N Dak
Minn
Wyo
3
S Dak
Wis
Mich
Me
Vt
NH
Mass
Co
RI
NY
Nev
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Calif
Utah
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Alaska
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Organization Chart

DEPARTMENT OF THE INTERIOR

Bureau of Land Management

FORESTRY PROGRAM IN AN EXPANDING ECONOMY

Conservation and development of all the renewable natural resources on the public lands can play a vital part in increasing the Nation's productive power and in helping to assure national security. Proper management of the forests and woodlands for continuous yields of the maximum volume of wood products is essential to the economic well-being of the Nation.

Management was continued and intensified during fiscal year 1950 to the greatest extent possible with available funds. Three million acres of commercial forest and 25,000,000 acres of woodland on public domain in the United States are being brought under management. Prior to 1949, these lands lacked any organized management except for fire protection.

Public Law 291, which was enacted by the Eightieth Congress, made the above program possible. This law authorizes the sale of live timber from the public domain thus clearing the way for resource management. These lands are widely dispersed in the western United States and are being developed into an important source of timber and other forest products for numerous communities which rely on such resources as the basis for industry and employment of labor.

Forest Management Produces Income

During the second year of management nearly 51 million board feet of timber were marketed for $396,453, which was approximately double the cost of administration thereby producing net income to the Treasury. In selling timber from these lands only the mature and overmature trees are marked for cutting. The younger trees are reserved for further growth and for harvesting in the later cutting cycles. Continuation and intensification of this management program including protection, will result in yields of timber several fold greater than are being harvested now.

Functions of Forestry Staff

The chief functions of the BLM's forestry staff are to develop and conduct a forest management program designed to help meet the needs of a constantly changing and expanding economy demanding more and more forest products. These functions fall into the following classes: (1) Protection of forest and range resources against destruction by fire, insects, and diseases; (2) Marketing 650 million board feet of mature timber as an average annual sustained yield on the O. & C. lands and 100 million board feet elsewhere on the public domain; and (3) The development of a more vigorous growing stock of timber on the lands so that the capacity of the soil shall be fully utilized and the annual sustained yield of timber developed to the highest practical level.

Actions either initiated or proposed for the solution of known operational problems include intensification of fire prevention and suppression and disease and insect control; inventory of valuable mature timber and growing stocks of younger timber on the O. & C. lands and public domain lands elsewhere in the Western States and Alaska; preparation of management plans for timber and other resources including woodland management plans for grazing districts; a program of watershed management; marketing programs for indicated volumes of timber including wood-waste utilization studies; improvement of present growing stock and reforesting of lands denuded by forest fires; and construction of access roads designed to reach presently inaccessible stands of mature and overmature timber.

PROTECTION

Protection from damage by destructive agencies—disease, insects, and particularly fire—is a prerequisite to successful management of renewable resources.

Fire control.—The Bureau of Land Management has never had a fire-control organization large enough to provide adequate organized protection to all of the public lands under its jurisdiction.

Bureau employees as a result of a strong sense of loyalty and responsibility, have each year endeavored to keep the burned acreage as small as possible with the least possible outlay of funds. At present both communication and suppression equipment is badly in need of replacement. In 1950, in order to improve results in keeping burned acreage at a minimum and to make more efficient use of fire control personnel, the regional administrators were authorized to make regional and interregional exchanges of fire-control personnel in the event of a fire emergency.

Close cooperation with State and county organizations as well as with Federal agencies is basic to the fire presuppression program which includes active participation in fire training schools and other local training meetings held prior to the fire season. Similar cooperation exists in suppression activities by closely integrated use of equipment and supervisory personnel.

In Alaska the Division of Forestry maintains a well-organized fire control organization which furnished effective protection to 18,000,000 acres in the developed and more accessible areas around Anchorage and Fairbanks along railroads, highways, and streams and other areas accessible to fire suppression equipment such as air bases, landing fields and lakes in other parts of Alaska. Because of a shortage of funds and inaccessibility only limited protection can be extended to the remainder of Alaska.

Airplanes equipped with radio are used extensively in detection and scouting of fires and for directing operations from the air. A well organized radio communication system makes possible rapid action in reporting fires and follow-up in directing the work of suppression crews.

In the five Western States of California, Idaho, Oregon, Montana, and Washington, 3,000,000 acres of scattered timber lands located in areas too far from grazing district fire control units to permit economical fire control are under contract protection with the States, State protective associations, and the Forest Service. The O. & C. lands in Oregon which constitute over 2,500,000 acres of commercial timber in the Douglas fir region are under contract protection with the State of Oregon, the State protective associations, and the United States Forest Service.

Disease control.—Disease prevention and control in our commercial timber stands are essential to good forest management and the production of quality timber. White pine blister rust, a disease common to the white pines, requires two host plants, the white pine (the sugar pine, eastern and western white pine) and plants of the genus Ribes or currant. A ribes eradication project was started in 1942 in 150,000 acres of commercial white pine timber mostly of the sugar pine species on the O. & C. lands in western Oregon.

The project during calendar year 1949 treated 3,119 acres of O. & C. and national forest land with initial eradication and 8,606 acres with reeradication.

Insect control.—Insect pests take a heavy toll of timber stands each year. The spruce budworm epidemic in the Douglas fir forests of Oregon and Washington threatened wholesale destruction to 2,267,000 acres in 1949 after a small beginning in 1944. The control program for 1950 together with that of 1949 covered most of the critically infested areas. The 1950 program included treatment of 4,760 acres of public domain in eastern, central, and western Oregon. Results have been highly effective.

INVENTORY

Inventory of mature stands and growing stocks of younger timber is an essential requirement in planning the management of a forest property. Valuable stands of timber on the O. & C. lands and on the public domain lands should be systematically inventoried to obtain information not only concerning volume but also on such factors as age, quality, size, and location of the commercial timber species, topographic and geologic features, locations of roads, and locations of wood-using industries.

As a result of the completion of intensive inventories on several O. & C. administrative units, it is being found possible to increase greatly the sustained yield allowable cut for these units. If inventories for other units produce data following the same trend, it is estimated that the annual sustained-yield cut may be raised to a volume substantially greater than the present limit. Actual cutting which in the past has averaged far below the allowable volume probably can be doubled.

Accurate volume tables are an essential requirement in an extensive program of forest inventory. The Bureau's Alaskan Forestry Division continued to gather data necessary for the compilation of volume tables covering the forest species of interior Alaska.

Management Plans

Management plans for timber and other resources have been prepared in well organized form for the O. & C. lands. Their periodic revision and intensification has been in progress as required to reflect the results of better fire protection, improving utilization standards and more accurate inventory data.

Elsewhere in other Western States recent studies show that woodland areas are yielding products of great local value and that these areas are worthy of more intensive management and protection from fire and trespass. Similar management plans for other regions are in preparation. Most of these woodlands are also grazing lands. Thus the woodland management program is especially valuable serving a double use and producing a double income.

In the Bureau's region IV, comprised of the States of Colorado and Utah, a program of preparing woodland management plans for each grazing district was initiated in 1950. The plans are simple and based on the limited inventory knowledge available to the regional forester and range managers. Provision is made to adjust and intensify these plans as additional data become available. Most of the grazing districts of this region now have these plans and are finding them valuable as an administrative tool. These plans are an important step toward providing the intermountain country with a continuous supply of woodland resources, particularly fence posts and other round wood products used for ranch structures in the steadily expanding grazing industry segment of the national economy.

Watershed Management

In region I increasing attention is being directed to watershed management. Water supply and erosion problems are constantly requiring closer attention in plans for the management of the other forest resources.

Watershed protection on timber sale areas, requires bridging of small streams, and prohibiting the yarding of logs across them in order to prevent the disturbance of water courses and water contamination. Provision is made for maintaining sufficient forest growth bordering stream courses so that satisfactory water temperatures are maintained above fish hatcheries and along fishing streams.

An improved method of harvesting timber in Douglas fir stands by the use of staggered settings has also provided for better watershed conditions. By this method, small areas varying from 25 to 45 acres in size are clear cut. The surrounding uncut timber provides the seed for early natural regeneration. It likewise retards evaporation of moisture from the forest litter and soil by reducing the movement of air.

MARKETING

Marketing programs for definite volumes of timber on O. & C. lands beginning soon after the passage of the O. & C. Act of 1937 have been guided by systematic management plans.

Since January 1, 1950, an improved timber-sale procedure on the O. & C. lands has been followed with excellent results.

A sales program for an entire year in advance reflecting the suggestions of interested lumbermen and tailored to fit sustained yield plans is developed in consultation with local advisory boards. The details of the plan are given wide publicity. The advantage of this procedure to the industry is that it gives interested operators abundant time to investigate tracts of timber to be marketed. It also aids the forestry staff in avoiding fruitless and time-consuming work which formerly was performed as a result of acting on indiscriminate applications.

For the fiscal year 1950 the advance timber sale program resulted in the sale of 413,403,000 board feet, which is 56 percent more than the volume sold in the fiscal year 1949. The average selling price was $12.00 per thousand board feet.

Receipts from O. & C. and Coos Bay Wagon Road lands, principally from timber sales, for the 1950 fiscal year, were $4,005,156.

IMPROVEMENT OF GROWING STOCK

Improvement of the forest growing stock with the ultimate objective of an expanded average timber yield is being accomplished by the following program: (1) All timber sales contracts require practices of proven success in obtaining prompt and complete reforestation of all openings created by timber removal; (2) timber sale operations are concentrated in the stands of overripe and deteriorating timber until such stands are replaced by vigorous young growth; and (3) all areas now in a deforested condition due to fires and other destructive agents on which reforestation by natural processes appears unlikely or liable to be too long deferred are to be replanted. The speed at which plans to reforest these denuded areas are completed is dependent upon appropriations for this purpose. Planting of seedings by hand labor is a costly operation but the long-run cost of idle lands is even greater.

Access Roads

In certain more remote localities of the O. & C. lands the marketing of overripe timber and timber deteriorating as a consequence of damage by fire, insects, diseases, windthrow, and other destructive agents has been impossible because of inaccessibility. Contract authority was granted by Congress for a start on a $10 million program of access roads in fiscal year 1950; however, no mileage was actually constructed. An agreement was worked out during the year with the Bureau of Public Roads providing for engineering and construction.

Since wood is a critical material in time of national emergency the National Security Resources Board is interested in plans to provide the maximum allowable production of timber in such an event. A report has been submitted to the NSRB listing all proposed O. & C. access road projects. To obtain a full sustained-yield rate of production from all of the undeveloped stands of timber on the O. & C. lands would require a much greater program of construction than is contemplated. Much of the required road system for the O. & C. lands will be constructed by loggers and owners of the timber on intermingled private lands. Government access roads are planned primarily for the larger land units and where private construction otherwise will be too slow to meet conservation and national defense requirements.

LEGISLATION AFFECTING PUBLIC LANDS

A number of important laws affecting Bureau of Land Management operations were enacted this past year.

Development of Alaska

Legislation designed to promote the development of Alaska received a great deal of attention. Perhaps the most sigfinificant enactment is one affecting all public lands but particularly welcome in the Territory. This is Public Law 361 which authorizes the granting of farm loans by the Department of Agriculture to homestead entrymen. Previously, an unpatented homestead entry did not constitute an adequate security interest for a loan since, upon default in meeting the entry requirements, it would revert to the public domain. The new law provides a method whereby the entries may be made a sound security basis for loans and the two Departments have established a procedure for the processing of the loans. Thus, an effective source for financing homesteaders has at last been provided, and a serious impediment to homesteading has been lessened.

Prospects for nonagricultural Alaskan development were boosted by three other acts. Public Law 275 permits the sale of tracts in Alaska for commercial and industrial purposes, including housing. This law will aid in filling a serious hiatus in the laws affecting the Territory since previously the methods whereby commercial industrial sites could be acquired were tortuous and uncertain. The new law and the regulations establish safeguards against speculation and at the same time provide for competitive bidding.

The Bureau has functions under the Alaska Housing Act (Public Law 52) and the Alaska Public Works Act (Public Law 264), both of which will play a helpful role. The former should spur housing development, and the latter should have a similar effect on public works. Under both the Bureau will be charged with the transfer of public lands for these beneficial purposes.

Finally, with respect to Alaska, a somewhat technical but very valuable act, Public Law 493, requires the recordation of settlement claims in the land offices. Previously such claims were recorded, if at all, in the Office of the United States Commissioner while all entries, leases, etc., were recorded in the land office. This dispersion of records meant that land offices could not keep or give accurate information on the status of the public lands. This, of course, resulted in uncertainty and confusion which now, under the corresponding regulations which have been approved, will be alleviated.

Mining on the Public Domain

Two acts affected mining on the public domain. Public Law 115 authorizes the Secretary to defer assessment work on individual claims for up to 2 years where claimants are prevented by legal impediments from gaining access to the claims. The administration of this act has been delegated to the Bureau, and regulations were prepared to put it into effect. Public Law 107 extended the moratorium on mining claim assessment work to include the year ending July 1, 1949. The act also allowed work done in that year to be credited in the succeeding year. Public Law 544 was enacted later to provide a procedure for claiming this credit. Both laws contained sections designed to provide added protection to owners of the surface of lands patented with mineral reservations to the United States by providing for compensation for damages to grazing values caused by strip mining in instances where damages to crops and improvements already are compensable. While this clause does not affect outstanding mineral leases, it should, in the future, prove to be a definite aid in securing full multiple use of the land resources coming within the scope of the bill. Appropriate changes in the regulations have been drafted. Just before the close of the fiscal year, Congress passed Public Law 582 which extended the time for doing assessment work this year until October 1, 1950. The significance of the action lies in the fact that the committees of both the House and the Senate issued stern warnings that further moratoria and extensions are not to be expected.

Cadastral Engineering Work

The cadastral engineering work of the Bureau will be materially expedited by Public Law 490, a departmentally sponsored act which amended the rules of survey to allow considerable flexibility in making surveys of areas topographically not suited for strict conformity to the rectangular survey system. Thus some areas formerly almost impossible to survey can now be surveyed, and the expense of surveys in some other difficult areas will be materially lessened.

General Services Act

The General Services Act (Public Law 152) raised two matters for the Bureau's consideration. First, the extent of the act's exclusion of the public domain from its scope has been a subject of considerable discussion with the General Services Administration. It is hoped that, as a result, an amendment will be proposed to the Eighty-second Congress by the General Services Administration to clarify the meaning of the term as used in the act. Second, the Secretary has delegated to the Bureau his functions, under the act, of enforcing and modifying the use and reversionary clauses in conveyances to public agencies, for park purposes under the former Surplus Property Act. While some assistance is to be given by the National Park Service, the primary responsibility has been put in the Bureau with a resultant increase, of course, in the workload in the Office of the Chief Counsel.

Finally, Public Law 226 divided an area of intermixed public domain and acquired soil conservation lands in New Mexico between the United States and the Pueblo and Canoncito Indians. The Bureau prepared regulations and several orders to effectuate the act.

Revision of Land Laws Proposed

It is in the unenacted portion of the Bureau's program that a large part of the hope for further improvement in the administration of the public land lies. The Bureau has decentralized its operations, it has studied thoroughly, revised and improved its procedures, it has widened its outlook and has increased its output per employee enormously. But the patchwork pattern of the thousands of laws under which the agency operates is to a large degree outmoded and incoherent. Law after law and amendment after amendment have been enacted to meet a particular circumstance or the special exigencies of a certain time. But once enacted, there they remain to plague the public and impede the administrator.

The Bureau and the Office of the Chief Counsel have attacked this problem in the only way their limited staff and resources permit, that is on a piecemeal basis as the need for revision of particular laws has become so acute that it could not be disregarded. Efforts to date can be regarded as no more than a small beginning at a much larger task.

There are many unsuspected and sometimes illogical traps awaiting public-land applicants to delay, impede, or even make impossible the perfection of their effort to secure a farm, a home, a mine, or a privilege to make valuable use of the public lands.

It was with the scope of the complete revision and consolidation to fit effectively the public land laws into an expanding national economy that the Office of the Chief Counsel prepared, as the fiscal year neared its close, a draft of a joint legislative and executive commission to study and prepare a workable, up-to-date, and correlated revision of the public land laws. Through such a commission, adequately staffed, the thoroughgoing revision can be accomplished in the foreseeable future.

Congress also has before it several important public land bills other than those already described. There is, for example, a bill to promote the settlement of Alaska by permitting some degree of planning in settlement projects, by authorizing claims more in tune to the Territory's needs than those permitted by the homestead laws, and by authorizing the Interior and Agriculture Departments to extend both physical and financial assistance to settlers.

Regulations

In addition to regulations which were prepared in order to put into effect the various laws enacted during the year, a number of regulations were approved during the year to make more effective the public service of the Bureau and to give the lands and resources under its jurisdiction a greater part in the expanding national economy.

The more significant of these included the revision of the road right-of-way regulations for the Oregon and California revested railroad grant lands in order to make accessible more Government timber on a competitive basis by providing for joint use of the roads by all purchasers of the timber; the regulations relating to the exchange of lands within national forests, which were revised to simplify and speed up the joint handling of the exchanges by the Forest Service and the Bureau, and to eliminate the necessity for secretarial approval of such exchanges; the revision of the town-site regulations to provide a general and workable procedure for the disposal of lands in all town sites, thus making unnecessary the future issuance of special regulations for each individual town site; the revision of the Alaska grazing regulations to make them simpler, more understandable, and more workable; the establishment, by regulation, of a policy making possible equitable distribution of lands along the highways in Alaska; a revision of the regulations relating to the sale of timber and other material on the public lands to reflect experience since the enactment of the Materials Act in 1947; a revised stipulation required of applicants for power line rights-of-way permitting the interconnection of Federal power lines with private lines over Federal lands, for the purpose of transmitting power from Federal projects; and an amendment to the coal regulations to allow holders of coal permits and leases on the Choctaw-Chickasaw Indian lands in Oklahoma which are being conveyed to the Government to continue in business on a firm basis.

The office completed a major editing job, in cooperation with the editors of the Federal Register, when it reviewed all of the regulations in title 43 of the Code of Federal Regulations and made the editorial revisions necessary to conform them with the present structure of the Bureau for the 1949 edition of the code.

Cooperation With Other Agencies

The instances in which this office cooperated with other agencies both inside and outside the Department illustrate the importance of the public lands in the national economy, and how frequently the Bureau's actions involve a broad public interest.

Three important acts discussed in detail in the legislative section involve cooperation with other Federal agencies in the issuance of farm loans on homestead entries, and in the promotion of housing and public works in Alaska by use of public lands for these projects.

During the whole year the Bureau worked closely with the Division of Power, the Solicitor's Office, and with other agencies in the Department in formulating coordinated policies on power lines and other rights-of-way.

Several other regulations drafted by this office or in the preparation of which it participated, affect and were worked out with other agencies. The oil and gas lease forms and regulations involved close cooperation with the Geological Survey; regulations covering the public land interests of all departmental employees were prepared after consultation throughout the Department; and regulations governing forest exchanges, cutting down considerably on the former intricate procedure, were worked out with the Forest Service of the Department of Agriculture.

Other outstanding examples of cooperation are found in the following: The preparation of an order governing the procedure to be followed by departmental agencies in requesting and processing withdrawals; the securing of the return of Angel Island in San Francisco Bay to the public domain by the General Services Administration at the request of the National Park Service so that it could be preserved for public recreational use under the Recreation Act (43 U. S. C., sec. 869); the working out of an agreement with the Atomic Energy Commission to allow grazing in the vicinity of Arco, Idaho, on lands withdrawn for the Commission; numerous conferences and discussions with the Department of Defense and its components to secure satisfactory solutions of many problems arising from the proposed military and naval withdrawals in New Mexico and Alaska; the preparation for the President's Water Resources Commission of extensive material on legal phases of its water resources study; negotiations and considerable cooperative effort with the Bureau of Indian Affairs in securing satisfactory deeds transferring to the United States the title to a large area in Oklahoma purchased by the Government from the Choctaw and Chickasaw tribes, and satisfactory interim administration of the area pending the acceptance of the deeds; and a great deal of time spent on joint legislative problems such as those relating to the public land provisions of the Alaska statehood bill and the Bureau of the Budget's study of payments by the Federal Government to State and local governments in lieu of taxes on Federal property.

LITIGATION

While the office does not represent the Government in court, it cooperates closely with the Department of Justice in lawsuits involving the Bureau and its interests. The subject matter of the principal litigation during the year illustrates in how many ways and in how many places the Bureau's activities affect the national economy.

Following the Supreme Court decisions holding that the oil and gas in the submerged lands off the coasts of Louisiana and Texas were subject to Federal, not State, jurisdiction, the office participated in negotiations to find an effective plan for the administration of these resources. At the end of the year the negotiations were still being carried on as were similar ones relating to the lands off the California shore.

The office also participated in suits involving the ownership of abandoned steel rails in Alaska, settled favorably to the Government; the use of power line rights-of-way in Idaho; the validity of certain Louisiana statutes relating to mineral reservations; the ownership of oil and gas below the Illinois Central Railroad right-of-way; and several involving trespass on the public domain.

Significant to the economy of the West and of the whole Nation was the preparation of material for presentation to the Federal Power Commission in proceedings involving oil and gas pipelines on the public domain. Under the Mineral Leasing Act, such pipelines must be operated as common carriers. However, in fact, they have not been so operated, and there have been some indications that the pipeline companies may resist efforts to enforce the common-carrier provision of the law. The Department has taken a strong stand in favor of all-out efforts to require the companies to meet their statutory obligations. If resistance develops, litigations may be expected to enforce the law.

LOOKING AHEAD

The Bureau's Goal

Extremely important to the expanding economy of the United States is the development of the Western States and of Alaska. The West has shown phenomenal growth in the past several years. On the other hand, Alaska is now upon the threshold of its real development.

Basic to the development of these areas, of course, is their land and related resources. The importance of the Bureau of Land Management to economic expansion in these areas can be readily appreciated when it is realized that the Bureau administers 25 percent of the land area in the West and 80 percent of the surface area in Alaska. How well the Bureau manages its vast resources, timber, grass, minerals, and others, will have an important effect upon the welfare of the people in those areas. The Bureau has set as its goal the prime objective of managing its lands so that they will make a maximum contribution to the expanding economy of the Nation and to economies of the area in which it operates.

To accomplish its primary objective, the Bureau must direct all its management operations to the one common objective. This requires careful planning based upon sound research.

Planning and Research

The ultimate objective of planning is to provide the Bureau with a coordinated, efficient, and balanced program so that available funds and personnel will yield an optimum return to the people of the United States. Its plans must also provide that its program be coordinated with the programs of other Government agencies and must be consistent with the needs and potentialities of local economies.

Formulation of a well-conceived program is wholly dependent upon the availability of facts. This calls for a comprehensive program involving inventory of the lands and resources, the classification of the lands, economic studies, local industries and economies which are dependent in part upon the public lands, and related matters.

As such material is gathered and analyzed it must be translated into an action program. Program plans must be developed which serve as guides for the day-to-day management activities of the Bureau.

Program Plans

The central concept of the Bureau's planning and research program is the development of long-term plans for the entire Bureau. These plans are being developed in the districts where contact with resources and the uses of these resources are direct. When completed, they will outline the ultimate goals of the Bureau and will indicate the lines of action which must be taken to achieve them. During the past year a considerable amount of work was done in formulating these operating plans. The detailed planning is under the guidance of the regional administrators and the Director's office, and will be formed from regional plans into an over-all program for the entire Bureau. Plans will be kept current as day-to-day operations reveal new directions and new opportunities.

Area Studies

A central theme of the Bureau's program is the administration of the public lands on an area basis. The aim of the Bureau is, as funds become available, to undertake basic studies of the resources and the condition of the land in the areas in which it operates. Only in this fashion can the administration of the public domain be truly integrated with local economies.

As rapidly as funds permit, the Bureau is carrying out studies to provide the information on the current condition of and the potential production on the surface of public lands.

These studies provide an inventory of the surface resources of our public land areas and are basic to the development of a land disposal and management policy consistent with the public interest. Such studies are well along in the Missouri Basin and in Alaska.

Several reports have been released showing the results of these studies in various of the subunits of the Missouri River Basin. These reports summarize the character and the value of the public lands in these units and indicate the management program which should be adopted for them. Comprehensive studies are undertaken in areas where the demand for land is greatest. Area classifications under these circumstances have produced solutions for some very complex land-use problems. In Alaska several area classification studies have been inaugurated with special funds to determine and develop settlement opportunities in the Territory. In the frontier conditions of Alaska the Bureau's land classification studies and studies of economic opportunities are revealing important facts which are basic to a sound settlement program in the Territory.

Economic Problems

Extensive research into many economic and technical problems is needed. Important among these are the needs of the local communities and people so far as the public lands are concerned. Careful watch must be maintained to insure that public land procedures support and expand the economy and do not serve to restrict development in any area. The Bureau is limited as to the attack it can take on these problems, but, through cooperation with other groups and agencies, increasing attention is being given to resarch on such matters and plans envision great expansion of these activities as funds become available.

Field Examination Cases

With the expanding economy and growth of population in the Western States the Bureau receives an increasing number of applications for transfer of title or for use of the resources on public lands.

As the resources are for the most part committeed to some use these applications require careful examination to insure that the use of the lands applied for will be in the public interest.

During the fiscal year ending June 1950, the Bureau was called on to examine and make recommendations on about 10,000 applications.

The demand stresses the urgency for an inventory of resources on public lands and an area classification for use so that resources can be made available to the public and to reduce the load of cases requiring special time-consuming examination.

International Activities

Increasing demands are being made on the Bureau for technical advice regarding public land policies and procedures in underdeveloped countries. In handling the public lands of the United States, which lie in the less developed regions, the Bureau's staff has experience in essentially all of the specialized fields of public land administration, including cadastral engineering, land titles, land classification, land planning, range management, forest management, land settlement, and mineral leasing. Economic progress in many of the underdeveloped countries is handicapped because of the lack of trained personnel to handle their land problems. Improvements in the welfare of the population and the ability to attract capital investment, for example, are closely related to the adequacy of the public land policies and practices.

Consideration is given to assigning technical personnel of the Bureau's staff to underdeveloped countries and for training representatives of the countries in the technical phases of public land administration in the United States. Arrangements were completed for the participation of Bureau officials in international technical conferences during the next fiscal year in cooperation with the Department of State and with the United Nations.

Underlying Objectives

Although the Bureau's program is being formulated on the basis of administration of areas, it is based on definite objectives which the Bureau wishes to accomplish. Foremost among these objectives is to manage all renewable resources on a substained-yield basis. An expanding economy requires the maintenance and improvement of these resources.

A second major program of the Bureau is the undertaking of a comprehensive soil- and moisture-conservation plan. Although the lands administered by the Bureau in general are not a major source of water because of their location, they do contribute heavily to the silt-load of western streams. The objective of the conservation program is to reduce the movement of silt and the loss of water from its public lands.

A further objective of the Bureau is to try to correct land use maladjustments which have resulted from many years of indiscriminate disposals of public lands and of uncoordinated dispositions. The transfer to private ownership to other agencies, and to States and local governments of lands which can be managed better under other direction is receiving attention. In areas of complicated land patterns the Bureau will try by exchange or otherwise to rationalize land ownership in order to promote more effective administration and more stable tenure. Existing withdrawals and reservations will be reviewed to remove so far as possible restrictions on the use of public lands and resources.

For the areas which will remain under administration of the Bureau, plans contemplate multiple use to the full capacity of the lands and resources. The increasing demand for all resources on the public lands can be met to the fullest extent only through multiple-use management. The corollary of this principle is that conflicting use demands must be fully evaluated so that the lands are ultimately devoted to their proper use.

Under the decentralized plan, responsibility for much of the Bureau's work is in the seven regional offices. The following brief reports give a few high lights from each of the regions.

REGIONAL REPORTS

Region I, Headquarters, Portland, Oreg.

The population and industrial growth of the Pacific Northwest during the past decade have emphasized the significance of the objectives of the Bureau in region I. The forage, timber, mineral, wildlife and recreation resources under its administration take on added importance as basic ingredients in the enlarged economy which must supply livelihoods to a populace that is currently increasing at a rate of between 4 and 5 percent per year.

Consistent with its long range goals of conservation, region I has, during the past year, applied several effective measures to increase the economic usefulness of its timber and other land resources. Much thought has also been given to the multiple uses of the land for watershed protection, wildlife shelter, and recreational purposes.

Specifically, the Bureau through its access roads and right-of-way programs, its forest inventory and advance timber sale programs, its reforestation and forest protection programs, and through the other phases of its forest-management program is moving to make more timber available to the lumber industry. Currently, it appears probable that the 413 million board feet of timber sold in fiscal year 1950 may eventually be increased substantially per year without exceeding the sustained-yield-allowable cut which it is anticipated may subsequently be established. This realization of the full potential sustained-yield cut from the Bureau's commercial forest lands in the Pacific Northwest will be of substantial benefit not only in meeting the requirements of an expanding economy but will be absolutely essential in the event of full-scale mobilization for national security reasons.

The Bureau has continued with preparatory work necessary to the development of cooperative sustained yield units in areas in western Oregon where O. & C. and private lands are so situated as to indicate such units are needed for community and employment stabilization.

Advisory boards serving in both the O. & C. and grazing areas were an asset to the Bureau during the past year. They brought to the periodic meetings both advice and constructive criticism based upon their knowledge of local conditions which was valuable as a guide in administration. In addition to assuring the Bureau, and the public the Bureau serves, of objectivity and equity in the disposal of public resources, these advisory boards have served to interpret the Bureau's program, including the necessity for conservation management of public lands, to the groups they represent and to other interests in the communities.

Region I of the Bureau administers some 25½ million acres of grazing lands. To meet the increasing national and regional requirements for food, fiber, and livestock products, the Bureau's objective is to achieve the maximum sustained yield potential production of these lands. At the present time it is conservatively estimated that these lands are producing at somewhat less than 50 percent of their potential.

For the purpose of achieving greater economy and efficiency, and to provide a central location in each State for all public land records, the public survey offices in the States of Washington and Idaho were combined into an integrated land and survey office.

REGION II, HEADQUARTERS, SAN FRANCISCO, CALIF.

During the past year several important office changes in region II were made as follows:

The land office which had been located at Carson City for over 75 years was moved to Reno in August 1949 and consolidated with the Survey office there to become the land and survey office of the Bureau of Land Management for Nevada. The office of the Division Chief of Range Management was moved from San Francisco to Reno in March 1950 to become an important part of the BLM activities for region II located in Nevada. At the same time, the district range manager's office was moved from Reno to Carson City in space vacated by the land office.

Following the land office move from Carson City to Reno, the office cadastral engineer was transferred from Reno to San Francisco along with the other cadastral engineers who were transferred from Glendale to San Francisco to form a regional headquarters cadastral engineering staff under direct supervision of the regional cadastral engineer.

The Nevada survey records have now been microfilmed, with the California plats and field notes in process. As soon as this project is completed the public will be able to view desired plat or field note records at the respective land offices where the microfilmed positives will soon be available.

Progress on reseeding areas was particularly marked, both as to acreage planted and as to increase in cooperation from individual livestock operators. This has resulted in requests for greater participation on the part of users as to requested reseeding projects than the agency is able to authorize on the basis of present and anticipated soil and moisture conservation funds. In one project in Nevada, Mitchell pasture in Nevada–1, where 450 acres were planted to crested wheatgrass in 1945 with 8 pounds to the acre at a cost of $5 per acre, the area was stocked in 1947–48–49 and 50 with an average daily gain of 2.63 pounds per day for approximately 100 head, or 3.04 acres per animal-unit-month for a 3-year average. At 20 cents per pound, the return for 1950 season was $2.60 per acre alone so that in two seasons it has more than paid for itself. Plans are for a considerable increase in area reseeding for 1950–51.

The total amount of receipts covered into the United States Treasury for the fiscal year 1950 amounted to $9,224,628.24. The total expenditures for "Management, protection, and disposal of public lands" for the year were $658,269.00. This region has therefore earned an income of $14 for each dollar of expenditure.

Region III, Headquarters, Billings, Mont.

The closing of the Great Falls district land office and moving and consolidating it with the Billings district land office at Billings, and the closing of the public survey office at Helena and moving it to Billings were of major importance. These moves consolidated in one place all of the basic land records not only for Montana but North and South Dakota as well, and also centralized the responsibility for actions on public land matters.

On December 12, 1949, the district land offices at Evanston and Buffalo were discontinued and archives of those offices consolidated with the district land office at Cheyenne, Wyo. This consolidation of land offices was completed on January 16, 1950. In addition to these moves, the public survey office located at Cheyenne since approximately 1870 was consolidated with the land office.

The area classification program being carried on by the Division of Land Planning under the Missouri Basin project covered 2,000,000 acres of detailed surveys of public domain and 790,000 acres of reconnaissance survey. Significant progress was made in bringing current basic public land status records, the lack of which has seriously handicapped all phases of management, classification, and adjudication activities. A systematic recordation of status of public lands in Wyoming and Montana was initiated. This recordation of all classes of public lands is virtually completed for Wyoming.

Total collections from all sources for the fiscal year 1950 amounted to nearly $11,000,000 in region III.

REGION IV. HEADQUARTERS, SALT LAKE CITY, UTAH

By directing all activities toward the objective of economic development by basins, a higher degree of coordinated effort within the Bureau and between BLM and other Federal and State agencies has been noted.

In addition to the extra services performed and the field collection of data for classification in connection with individual applications, detailed examination was made on 80,000 acres and general information secured on an additional 48,000 acres in the South Platte drainage of the Missouri Basin.

In administration of grazing lands emphasis has been placed on improving range conditions. The various areas within districts have been studied with a view to determining the places where overuse is occurring and, in the interest of conservation of the range and sediment control, taking corrective measures.

Soil and moisture conservation project planning has been directed more toward watershed rehabilitation as it relates to sedimentation and water conservation and use in the various major drainage basins.

The management and use of the scattered tracts of timber and the vast woodland types which have in the past not been given credit for being an important resource on public domain, have been given special attention.

During the fiscal year the Department of the Interior Colorado River-Great Basin field committee was established. Parts of region IV are located in the Southwest field committee region and parts in the Missouri Basin region. Planning activities of region IV have centered around the over-all programs of these basin committees.

During the fiscal year 1950 funds were made available to conduct Missouri Basin studies in the South Platte River drainage in Colorado, involving approximately 136,000 acres of public domain. In these studies detailed information on the character of the land, its capability and present condition, and local economy, is collected as a basis for determining its suitability for various uses.

Scope of basin planning is reflected in this region's participation in the preparation of the Colorado River-Great Basin field committee's report for the President's Water Resources Policy Commission. BLM's contribution concerned the relationship of land—principally watershed land—and water resources. In this study the lack of basic information, such as land records, cadastral surveys, maps, and land inventories as a basis for formulating policy for water conservation and use, became apparent and of major concern to all agencies dealing with these resources.

REGION V. HEADQUARTERS, ALBUQUERQUE, N. MEX.

The consolidation of two former New Mexico land offices, Las Cruces and Santa Fe, into one land and survey office at Santa Fe, early July 1949, has resulted in demonstrable advantages to the public and BLM in effecting economy, expediting action, and increasing efficiency.

Moving of the cadastral engineering division from Santa Fe to Albuquerque early July 1949 enabled the division to assume its proper place in regional office organization in the interest of integration of effort and policy and of economy and efficiency.

Establishing the division of adjudication with responsibility for supervising New Mexico and Arizona land and survey offices and handling Oklahoma cases, in addition to regular work of a regional adjudicator, has resulted in improved service to the public.

Establishing the division of land planning has recognized importance of this effort, knit together land classification and program planning functions and correlated both more effectively with other activities.

Establishing New Mexico grazing district 7 without special rules constitutes a long step forward in introducing control into a chaotic situation where both land and public relations had deteriorated over a long period previous to 1950.

Under informal authorization this agency assumed, May 1, 1949, jurisdiction of Choctaw-Chickasaw segregated coal and asphalt, underlying 387,000 acres of land in Oklahoma. The agency has surface jurisdiction over only 16,000 acres. Procedures for land use permits were devised for former lessees and permittees of the Choctaw-Chickasaw Nations. The Bureau is still engaged in preparation of conveyances from Indians to the United States.

Region V experienced an unprecedented run of agricultural homestead applications in the Crow Flats area of southeastern New Mexico, necessitating processing of some 1,700 cases, affecting 234,000 acres. Approximately 1,000 acres were found suitable for agricultural purposes.

Other regional high lights were:

Processing of San Manuel Copper Co. application for patent of 82 mining claims, said to be the largest single mineral application filed in the United States in the last 45 years;

Recognition by the Secretary of the Interior of the Magdalena Stock Driveway Association formalizing an effort which is outstanding in its attempt to regularize and improve a physical livestock marketing facility for approximately 12,000 cattle and 42,000 sheep.

Owing to unusual drought, the region was beset with a 13,000-acre grass-brush-forest fire in New Mexico and a 1,200-acre fire of like character in Arizona, as well as many smaller fires.

REGION VI, HEADQUARTERS, WASHINGTON, D. C.

Region VI has jurisdiction over public lands in 13 States. Five of these States are located west of the Mississippi River and eight are located east.

Because of the areas, character, and dispersed locations of the lands in this region, they are not, for the most part, susceptible to a land-management program; and, therefore, the policy is primarily that of land disposal.

The demand for such lands, particularly in Florida, has reached extensive proportions. The need for public use of such lands for recreation, park, or similar purposes must frequently be measured against the demands of individuals for home and business sites.

The timber resources on public domain lands in this region are of considerable importance. It has been estimated that in Arkansas alone this agency administers over $1,000,000 worth of merchantable timber.

Considerable commercial timber is located on the public domain lands in Minnesota and many valuable stands of merchantable timber are located on the lands in the other States of this region.

Related to the proper disposal and use of timberlands are matters of conservation, flood control, watershed protection, and consideration of land utilization. In Arkansas, situated within the boundaries of the Southwest field committee, are many projects of the Corps of Engineers in various stages of development and planning.

The area of public domain within the region, being widely dispersed, is located within three departmental field committee regions: the Missouri River Basin, region 5; the Southwest field committee, region 6, and the newly created Eastern field committee, region 7.

During the fiscal year 1950, the division of adjudication disposed of 2,829 cases. This exceeds the number of cases closed during the fiscal year 1949 by 2,124.

REGION VII, HEADQUARTERS, ANCHORAGE, ALASKA

More tracts were made available by the Bureau of Land Management for homes in Alaska principally for veterans during fiscal year 1950 than in any other comparable period of time. A total of 873 small-tract leases, some for business purposes as well as home and cabin sites, were in effect in Alaska by June 30, 1950. Veterans obtained an estimated 90 percent of the small tracts. Outlying communities in the vicinity of Anchorage and Fairbanks are being created by these new home builders.

At the same time, the Bureau pushed its surveying program, as patent cannot be issued before surveys are completed. This stepped-up program together with speeded up processes in the land offices through decentralization of authority to the field from Washington has resulted in patents reaching the land claimants at a greatly accelerated rate.

An important factor in the economy of Alaska was the making available of considerable grazing land to stockmen on Kodiak and Sitkinak Islands. Some leases were issued while others were in the process of being issued June 30. Timber from the public domain for domestic use of residents of Alaska is made available through the Bureau. Saw timber, fuel, house logs, fence posts, mine timbers are obtained through free use permit. Sales of timber on the public domain amounted to 12,530,661 board feet.

One of the most important phases of the Bureau's work is its fire suppression and presuppression program. Although its manpower is spread too thin to cope with fires effectively in the remote inaccessible places, the yearly average of burned-over area has shown a marked-downward trend for the past 10 years. It has been decidedly low during the past 3 years.

Fish and Wildlife Service

Albert M. Day, *Director*

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THE YEAR'S ACTIVITIES AND ACHIEVEMENTS, which are described in the following pages, have taken place in a geographic setting extending half way around the world, from America's east coast westward to the Philippines and from the Arctic almost to the Equator, reflecting the diverse and widely distributed character of the resources we seek to develop and conserve. In a broader sense, our activities have reached out to most parts of the world, through the medium of cooperative assistance extended to other countries in the conservation of their fisheries and wildlife, and through the exchange of scientific information. This encouraging growth of cooperation between nations, between States, and between local communities is the keystone of modern conservation.

In order to understand and to provide for the needs of terrestrial and aquatic wildlife, a great many apparently separate, but actually closely integrated studies and activities are continuously being carried forward on all fronts. This report suggests some of the highlights of the year's conservation problems and the steps which are being taken for their solution.

PACIFIC OCEANIC FISHERY INVESTIGATIONS

In the tropical and subtropical Pacific the United States has territories and island possessions, as well as responsibilities for the trust territories. As strategic assets these are vital. But, with the exception of Hawaii, they are economic liabilities. The land area is minuscule, and even its full utilization could only partially solve the economic problem. On the other hand the surrounding and intervening sea areas are tremendous. Resources of these vast water areas are untapped. The valuable tunas and other high-seas fishes that roam in these areas constitute the most promising untapped economic resource. They are also an invitation to other countries for economic invasion of the area.

Recognizing this, the Eightieth Congress declared the policy of developing and maintaining high-seas fisheries in these areas and charged the Fish and Wildlife Service with the responsibility of investigating, exploring, and developing the high-seas fishery resources of the tropical and subtropical Pacific territories and island possessions and intervening seas. To carry out this responsibility a unit known as the Pacific Oceanic Fishery Investigations (hereafter designated as POFI) was organized with headquarters at Honolulu, T. H., and through a series of conferences with the tuna fishing industry a program of biological, oceanographical, and exploratory investigations was developed.

The yellowfin and skipjack tunas are the primary resources to be studied, and initial surveys are taking place in the easterly areas of the region, from Hawaii out to Midway and south along the Line Islands to below the Equator and westerly to include the Phoenix Island group. The program is concerned chiefly with learning the distribution of tunas in commercial quantities, the relation of this distribution to the ocean-current system, the seasonal variations in the system and how they affect the distribution, migration, and availability of the tunas, the study of how much the tuna populations of one area mix with those of another, and in particular whether those of the central Pacific are a different stock from those along the coast of north and central America on one side of the Pacific and from those off the Asiatic lands on the other side.

Pursuit of these studies involves also the learning of the life history of the fish, where they spawn, how fast they grow, what depths below the surface they inhabit at different stages of growth, what food supplies they find, and what sea conditions, including food supply, determine their migrations and concentrations.

During 1950 the construction of facilities with which to work was completed and research work was begun on a full scale. Two ships of the YP 600 class obtained from the Navy were put into service in the early part of the year after considerable overhauling and alteration. A third vessel, an 85-foot wooden ship constructed along the lines of a west coast purse seiner, was delivered to the Service by the builder in the latter part of the fiscal year 1950. A laboratory building on the University of Hawaii campus was finished by the end of the year. Navy docking facilities in Pearl Harbor were put into service after repair and additions.

Of the nine voyages made after the vessels were completed, three were for the test and trial of equipment, two for survey of tuna abundance by live-bait fishing for tuna, one for a trial of experimental tuna longline equipment as a means of discovering the levels below the surface inhabited by tuna, one was a purse seine voyage, one was a hydrographic survey across the Equator, and one was a plankton cruise to determine the vertical distribution of eggs and fry of the tunas. The cruises have given experience and information regarding this portion of Oceania and its resources on which to base more intensive work.

Last year, a reconnaissance was begun of Japanese methods of tuna research and fisheries exploration. The major part of the material collected consists of scientific papers written in Japanese which have been hitherto unavailable because of the language barrier. A large number of these have been translated for the use of the POFI staff and also distributed to other research organizations and libraries.

Progress has been made in determining the geographical limits of the races of Pacific tunas. This is of importance because in view of the rapidly increasing catch, it may soon be necessary to know whether our fisheries are drawing from local stocks, or whether all the tuna in the seas pass our shores as well as those of other countries. In the case of the highly valuable yellowfin tuna (*Neothunnus macropterus*) it appears that the fish caught on the west coast of the Americas belong to a distinctly different group from those found in mid-ocean near the Hawaiian Islands; therefore, fishing activity in one area will not affect the supply in the other.

Paradoxically, although tunas have been an important source of food since ancient times, their wide distribution and far-ranging habits have made them difficult to study and there is considerable doubt as to how many separate species exist. The Fish and Wildlife Service is collecting series of specimens from oceanic localities through the world and may soon be able to clarify this problem.

Studies of the oceanography of the central Pacific Ocean were begun to determine the effect that oceanic conditions exert upon the availability and abundance of tunas. Several series of hydrographic observations have been taken from north of the Hawaiian Islands to 5° south latitude. Although this work started late in the year, much of the material has been analyzed and it will be published as a report on this little-known sector of the ocean. The occurrence of tunas and tuna food organisms is being compared with the characteristics of the ocean in which they are found. A better understanding of the factors controlling the movements and abundance of tunas will permit fishing operators to make their catches with greater regularity, and will also provide a basis for predicting where tunas may be found in unfished areas of the ocean.

The project to investigate the time and place of tuna spawning has met with some success. It may seem peculiar that we have only fragmentary information concerning the origin and replacement of a resource as valuable as this, but here again the wide spaces and difficulty of observation have retarded science. Although only a few tunas have been found which are in the spawning condition, over the past year fairly complete series of maturity stages have been assembled. Tows with fine meshed nets have yielded small tunas approximately one-fourth inch long from near the Hawaiian Islands, so it can be said with some certainty that spawning does occur in that region. Future months will determine when spawning is most common and whether or not it takes place only locally, or throughout the warmer waters of the Pacific Ocean.

Cooperative work has been performed with several other governmental agencies. The Pacific Oceanic Fishery Investigations has acted in the capacity of advisor to the Pacific islands trust territories governments in matters pertaining to the fisheries of the region. Observers have been furnished to investigate the trust territories tuna fisheries of the western and central Pacific Ocean. Synoptic weather reports have been routinely radioed to the weather bureau at Honolulu by Fish and Wildlife Service vessels when away from localities which have reporting observers. Close collaboration has existed with the University of Hawaii and the Territorial Fish and Game Commission.

UTILIZING THE FISHERY RESOURCES

The 1949 catch by United States fisheries was the second highest ever reported. It amounted to 4.9 billion pounds. The increases were largely in the menhaden, shrimp, and salmon fisheries. New shrimp grounds were discovered in the Key West area and shrimping activities in the western part of the Gulf of Mexico expanded. Activity in the menhaden industry increased in the Gulf area and along the Atlantic coast. Increased competition and technical conditions in warehouse stocks had depressing effects on the prices of canned fishery products and of fish oils, including vitamin oils. Fresh and frozen fishery products experienced an increase of demand and of prices. On the average, the price decline for all fish and shellfish, fresh, frozen, and canned, at wholesale level, amounted to about 5 percent. The export situation improved. About 50 percent more fishery products were exported in 1949, as compared to 1948. Imports remained at about the same level.

Service-operated vessels have been active in exploratory fishing during the year. On July 13, 1949, the 100-foot motor vessel *Oregon* was officially transferred to the Service for exploratory fishing in the Gulf of Mexico. Pending appropriation of operating funds for the Gulf, the *Oregon* was repaired and used to conduct a 3-month albacore-tuna survey in the waters off Washington and southeastern Alaska. Sizable schools of albacore tuna were located off the coast of Washington and in the international waters off British Columbia, but were found to be scarce in Alaskan waters.

A new 93-foot wooden exploratory fishing vessel, the *John N. Cobb*, was constructed in Tacoma, Wash., specifically for the Service's exploratory work in the North Pacific. The initial operation of the

Cobb was a combination shakedown cruise and shrimp survey in the inland waters of southeastern Alaska. A 4-month albacore-tuna survey by the *Cobb* in the offshore waters of the North Pacific located the first albacore tuna of the season; the *Cobb* followed the tuna north, informing commercial fishing fleets of the location of the tuna as the season progressed.

After its transfer to the Gulf, the FWS *Oregon* made two extensive exploratory fishing cruises. The first was along the Continental Shelf from the Mississippi River westward to the coast of Texas. Many schools of little tuna were located, but only a limited number were captured with the equipment available. Large shrimp were found generally distributed at depths of 50 fathoms. Snapper, grouper, and other species of fish were taken in a number of areas. The second extended cruise of the *Oregon* was made along the 100-fathom curve between the Mississippi River and the southern tip of Florida. There the *Oregon* located new productive snapper banks and found heavy concentrations of menhaden. The basic information obtained during these cruises will form a background for future planning of exploratory fishing operations in the Gulf.

In Service technological laboratories, new food materials which might prove useful in the feeding of hatchery-reared fish were surveyed. Sixteen different diet components have been evaluated in cooperation with the Leavenworth Hatchery. More than 14 possible new foods which have been surveyed by the Seattle laboratory will be subjected to feeding trials during the next year. Mixed diets and special-diet components from State and Federal fish hatcheries were subjected to chemical proximate analysis and assays for vitamin B_{12}, niacin, and riboflavin. The resulting data, correlated with feeding operations, will aid considerably in formulating proper diets for hatchery fish.

Continued laboratory tests indicate the superiority of fillets prepared from fish frozen in the round immediately after catching as compared with fillets prepared from fish which were first gutted and iced for a 10-day period. Tests have now proceeded to a point where commercial scale tests at sea, for which facilities are not presently available, are required.

During the year, trained Service home economists conducted 173 fish cookery demonstrations for homemakers, institutional managers, educational groups, and school-lunch supervisors. Supplementing the demonstrations were test kitchen reports, containing recommended methods for preparing fish and shellfish, which were given national distribution. In this field of direct consumer contact, considerable emphasis was directed toward the national school-lunch program.

Monthly availability reports on the fishery supply situation were provided to national restaurant, food-chain, hospital, and fishery associations. A quarterly market outlook report also was released for the guidance of Government and trade in planning and developing fishery programs.

One educational motion picture was produced, and a second, to be financed by the fishing industry but directed by the Service, was begun. The completed picture, Food for Thought, is primarily for use by school-lunch and other institutional food supervisors. The second picture, on the important menhaden industry, will show the importance of this fishery. Completion of these films will bring to eight the total of fishery films produced for educational use. It is estimated that upward of one-half million persons have viewed these films.

The monthly commercial fisheries' technological abstracting service was maintained during the year and provided current, concise information on the latest technological developments affecting the fisheries. This is the only domestic abstracting service available to researchers in this field.

In accordance with the authority vested in the Department by the Fishery Cooperative Marketing Act of 1934, numerous fishery cooperative associations throughout the United States were visited and their activities and conditions observed. The number of fishery cooperative marketing associations active in the United States has increased considerably during the past year, from 60 in May 1949 to 75 in May 1950.

The Service continued to aid the fishing industries in cases heard by the Interstate Commerce Commission which involved Railway Express Agency rates and charges for the transportation of fishery products.

An important Service function is the collection, tabulation, and publication of information on the employment of fishermen, fishing craft and gear engaged in the capture of fishery products, the volume and value of the catch, production of manufactured fishery products, the freezings and holdings of frozen fishery commodities, and related information. These data are essential in the management of the Nation's important fishery resources, which consist largely of populations of fish moving in interstate and international waters. The data are likewise essential in guiding the business activities of fishing industries and the local, State, and Federal Government agences having functions affecting the fisheries.

During the year, general statistical surveys to obtain operating unit and catch information were continued in the Pacific Coast, New England, Middle Atlantic, Chesapeake, and Gulf States. Data on the volume and value of the United States catch in the Great Lakes and the International Lakes of northern Minnesota were obtained, but it was not possible to secure information on the number of fishermen or quantity of gear operated in these lakes. It was likewise impossible to resume the catch and operating unit surveys of the South Atlantic States, which were last surveyed from 1945 data, or of the Mississippi River and its tributaries, which were last surveyed for 1931 data. Monthly and annual bulletins on the landings of fishery products in Maine and at the principal Massachusetts ports were continued. Early in the year a cooperative agreement was entered into with the Texas Game, Fish, and Oyster Commission for a monthly bulletin on the Texas catch according to gear and area of capture. Monthly statistics on the freezings and holdings of frozen fish and shellfish were published during the year, as was information on the monthly production of fish meal and oil.

The Fishery Market News Service again operated seven offices during the year, and several offices increased the scope of their activities.

To follow the catch in the New England area more closely, the Service issues preliminary monthly summaries of landings for New Bedford and Gloucester, Mass.; and Stonington, Conn. The importance of trash fish in the production of fish meal in the New England area became greater during the year, when many of the fishing vessels devoted their entire efforts to this fishery. To follow this new development, since it affects not only the supply of food fish but also fish meal, the Boston Market News Office now reports monthly on the quantity of fish caught especially for the reduction plants in the principal New England ports. The production of fish in the New England area for human consumption during the first 6 months of 1950 has been much less than for the same period in 1949. Diversion of fishing effort to trash fish has been one cause; other factors are reduced numbers of large fishing craft, inactivity of the whiting fleet because of large stocks of whiting in the freezers, and reduced availability of groundfish on nearby fishing banks.

The marketing of shrimp in the United States continued to increase during the past year, with prices remaining firm. The available supply was at least 18,000,000 pounds greater than in 1948–49, due to increased imports from Mexico, the discovery of new fishing grounds near Key West, and larger production in the States bordering the Gulf of Mexico. About 10,000,000 pounds of the increase was marketed; the balance went into storage. The sale of breaded fantail shrimp in consumer-sized packages was started by one small firm in Georgia; this product is now marketed in volume by more than 15 companies located in several of the shrimp-producing States and in the North.

ADMINISTRATION OF ALASKA FISHERIES

Management of the Commercial Fisheries

In Alaska the Federal Government, through the Fish and Wildlife Service, is responsible for the protection and conservation of the fishery resources, which are the basis of the Territory's most important industry. The year 1949 set a new record for the number of boats and units of gear operating in Alaska. Never in the history of the Territory has exploitation of the fisheries been so intense, and never has the need been so great for vigorously enforced, sound regulatory controls.

Fashioned within the guide lines established by the basic statutes for the protection of commercial fisheries of the Territory, revised regulations for the 1949 season were promulgated on February 19, 1949. Of special significance was the change which further retarded the pink-salmon season in the southeastern Alaska area to provide increased escapement during the early part of the run, which had shown marked evidence of excessive exploitation. The results were beneficial beyond expectations. The early escapement was excellent, and the salmon-canning industry in this part of Alaska experienced the best operating season in 8 years. Regulatory changes elsewhere were chiefly in the nature of minor adjustments, although the herring quota for southeastern Alaska was drastically curtailed because of reduced abundance of the local herring population. Field representatives again had authority to extend or curtail fishing seasons to meet promptly observed conditions of abundance which deviated from those anticipated when the regulations were drafted. Thirteen field announcements were issued during the season for this purpose.

A total of 20 permanent fishery-management biologists and enforcement agents were identified with fishery-conservation activities in Alaska during 1949. In addition to this staff, approximately 100 temporary seasonal patrol agents and stream guards were employed on enforcement duties during the active fishing season. This number was augmented by about 20 temporary enforcement personnel of the Territorial Fisheries Board who assisted in enforcing the Federal fishery statutes and regulations. A total of 8 seagoing patrol vessels, 14 small speedboats, and numerous smaller craft participated in fishery enforcement work in 1949. Eight airplanes engaged primarily in fishery-management and patrol activities, and some assistance was rendered by other Service aircraft assigned to game-management functions. Flights aggregating 1,396 hours were made in 1949 on the fishery-conservation program. The inforcement of fishery laws and regulations in general was more effective in 1949 than at any time since the beginning of World War II.

A total of 222 persons and concerns were apprehended and arraigned for violations of the Alaska fishery laws and regulations. Fines totaling $38,414 were assessed against the operators of 35 purse seines, 1 beach seine, 29 salmon gill nets, 1 salmon trap, 6 halibut boats, and 6 salmon trollers. Of this amount, $600 was suspended. In addition, suspended jail sentences totaling 600 days were imposed by the courts. Proceeds from the sales of confiscated fish exceeded $5,000.

In connection with the management of the salmon fisheries, which account for about 80 percent by volume and 90 percent by value of total fishery production in Alaska, a greatly expanded weir program was undertaken in 1949. A total of 15 weirs was operated, including 2 in the Bristol Bay area, 1 in the Chignik area, 4 in the Kodiak area, 1 in the Cook Inlet area, and 7 in the southeastern Alaska area. In addition to furnishing an exact measure of the ratio of catch to escapement, thereby making it possible to secure full compliance with the requirement of law that there be not less than a 50-percent escapement of salmon, these weirs provide precise information as to the time of arrival and duration of each run. This is information essential to sound regulation of the fishery.

Since the numerical strength of the Alaska salmon runs depends very largely upon the extent and success of spawning in the parent year, a determined effort is being made to provide a maximum amount of readily accessible spawning area. More than 100 barriers, in the form of log jams and beaver dams, blocking the ascent of salmon, were removed from streams of southeast and central Alaska, and fish ladders were constructed in three streams to facilitate their upstream migration to extensive spawning gravels.

Pribilof Islands Fur-Seal Industry

During 1949, 70,991 fur-seal skins were taken at the Pribilof Islands from surplus male animals. The 1948 take, by comparison, was 70,142. Of these, 20 percent constitute the Canadian share under the present international agreement prohibiting pelagic sealing. The byproducts plant operated in connection with the fur-seal industry produced 49,250 gallons of seal oil and 348 tons of meal, which were sold for the account of the Government for the total gross amount of $76,219.03. The 1948–49 season yielded 779 fox pelts on St. George Island; foxing operations were discontinued on St. Paul Island because of the poor quality of the pelts and adverse market for them.

During the fiscal year ending June 30, 1950, two public auction sales of fur-seal skins were held at St. Louis, Mo. A total of 25,394 skins were offered on October 10, 1949, and sold for a gross amount of $1,420,259.75. On April 17, 1950, there were offered and sold 29,800 sealskins, the gross sales price being $1,913,037.50. All of these skins were dressed, dyed, and finished in three shades, "Matara," "Safari," and black. Total gross sales of sealskins at the two auctions amounted to $3,333,297.25. In addition, a few skins were sold during the year at private sales for promotional purposes. During the year also, 327 foxskins from the Pribilof Islands were sold for a total of $1,509.25.

RESEARCH IN FISHERY MANAGEMENT

Marine Fisheries

Of the many problems connected with the biology of the seas, one of the most difficult is the understanding of the circumstances that, for brief periods, bring about an enormous growth of minute animals that collectively discolor thousands of acres of water and, by poisoning the fish life therein, cause great economic loss. Such occurrences, known throughout the world, have been repeated in the waters off Florida in the form of a "red tide." Studies of these phenomena which are being conducted at Sarasota, Fla., include a study of the normal nutrient supply of the waters in that region so as to provide a measure of the changes which precede and accompany such an epidemic. These measures, together with laboratory experiments on the nutritional requirements of the types of organisms which create the "red tide," are continuing as a means of providing a clue to the causes of these unbalances in nature.

The stocks of sardines which, until 1945, contributed a greater tonnage to the fishing industry than did any other species in this country, are under continuing observation. It is of interest to note that other major sardine fisheries, including those of the Mediterranean and of the far western Pacific, have undergone similar declines during recent years. These studies, conducted jointly by the Fish and Wildlife Service, the California Fish and Game Commission, Cripps Institution of Oceanography, the California Marine Research Committee, and the California Academy of Sciences, and with the cooperation of the States of Oregon and Washington and the province of British Columbia, involve physical, chemical, and biological assays of the ocean along the Pacific coast from Lower California to the Columbia River and extending hundreds of miles at sea. A considerable fund of knowledge of the other fishes in the region is being accumulated incidental to this study. It has become evident, for instance, that the anchovies are as abundant as the sardines, and that enormous numbers of sauries, jack mackerel, and several other fishes likewise exist. These, if not of immediate importance to man, are of great value in providing food for other carnivores, such as tunas, which are of such economic importance.

The great fisheries of the North Atlantic region have been under continuing observation through census studies of the stocks of the various fishes of these offshore banks.

Farming clams, like oysters, seems to promise better utilization of the resource and arrest of depletion on the Atlantic coast. Experimental work during the year in Massachusetts reveals that predation by horseshoe crabs has a greater effect on clam survival than had been supposed. Losses of more than 90 percent of transplanted clams in market areas were attributed to these predators alone. Methods of controlling predation are being tried concurrently with biological studies of natural flats, artificial spat collectors, and mortality from disease. Of special interest was the collection of 1,900 seed clams per square foot under a tested material, as compared with 3 to 10 per square foot on natural beds.

Because of a long-standing controversy over the effects of raking and power dredging of hard clams or quahogs in Rhode Island, the State requested the Service to study the biological effects of each on the resource in Narragansett Bay. Commercial fishing by each method in marked areas, under controlled conditions, followed by submarine photographs of the bottom, was carried on in the 1949 season and is being continued in 1950. At the termination of the project this year, it is expected that definitive results will have been obtained to settle the question for improved management of the fishery by the State.

A new specialized laboratory for oyster research was opened at Beaufort, N. C. With biochemical, culture, biological, and radiological laboratories, it is well equipped for a study of the effect of radioactivity resulting from the introduction of radioisotopes of different elements into tissues and organs of shellfish. The new project is a cooperative undertaking with the Atomic Energy Commission.

Interesting results have been obtained from other shellfish projects. For example, oyster research in Chesapeake Bay indicates that natural spawning on an oyster bar cannot be expected, under present conditions, to maintain a commercially dependable population of oysters without planting from other bars. European oysters planted in oyster-barren Maine waters last fall survived the winter well; the experiment is designed to test whether such an introduction is practicable from the standpoint of establishing a naturally maintained population of hardy, good-quality oysters where none now occur. A dramatic demonstration of the fact that the inferior appearance of many Gulf of Mexico oysters is due to lack of cultivation rather than inherent poor quality was made by laboratory experiments in Florida, involving separation of oysters; at the end of the year, they are remarkable for high quality, shape, and weight.

Study of the effects of the 1950 opening of the Bonnet Carre spillway on oysters indicated that the widespread serious damage to the beds after the 1945 opening was not repeated, but that oyster mortality from fresh water other than that from the Bonnet Carre spillway probably was intensified by the incursion of Mississippi River floodwaters. This work was done at the request of the States of Mississippi and Louisiana.

COASTAL FISHERIES

Studies at Karluk Lake, Kodiak Island, showed that, in laboratory-scale experiments, addition of chemical fertilizers will increase the abundance of organisms which supply food for young red salmon. Pilot fertilization of a small lake will be done in the summer of 1950, in preparation for possible fertilization of Karluk Lake itself. Other important findings relating to red salmon include discovery of a relation between temperature and the survival of young fish in the streams of Bristol Bay.

Research on the salmon populations of the Columbia River was centered about the problem of protecting runs of fish at water-use projects of the Corps of Engineers, the Bureau of Reclamation, and other construction agencies. A new type of fish ladder was tested, in comparison with the conventional pool type, and preliminary results indicate the new type is superior. Netting experiments at Bonneville Dam showed that young downstream migrants were distributed uniformly across the river, an important finding in designing fish-protective facilities.

Similar studies in the Delta region of the Sacramento-San Joaquin Rivers in relation to the Tracy pumping plant of the Bureau of Reclamation showed that the distribution of young salmon, shad, and striped bass is such that all pump intakes should be screened to prevent destruction of the young fish. Continuation of the sport fishery study of the upper Sacramento River emphasized the dramatic changes in upper-river fish populations brought about by the cooler water resulting from the operation of Shasta Dam.

Investigation of the shad of the Atlantic coast was increased several fold as a result of a special appropriation by the Eighty-first Congress. The initial studies are being concentrated on the Hudson River in an attempt to learn the cause of the recent large-scale fluctuations in abundance of the Hudson River shad.

INLAND FISHERIES

In October of 1949, the Great Lakes Fishery Investigations enlarged its staff to work on control of the sea lamprey as well as to keep a close watch on the condition of the Great Lakes Fishery which is changing rapidly because of direct and indirect influences of the sea lamprey. The ruin of the most profitable fishery in Lakes Huron and Michigan represents an annual loss of some $3,200,000 to the United States commercial fishermen, in addition to the unknown loss to sport fishermen.

Since October great progress has been made in the organization of a long-term program for the development and testing of methods of controlling this parasite. It includes: Development and testing of control devices and procedures, including the accumulation of reasonably exact data on costs of installation and operation of various devices; extension of studies on the life history and habits of the sea lamprey with a view toward determining better the vulnerable stages of the life history; surveys of streams to ascertain the distribution of sea lamprey runs, the extent of available spawning grounds and larval habitats; studies of species subject to attacks by sea lampreys to learn the incidence of attacks and the effects on abundance.

Mechanical devices—weirs, traps, dams—for the blocking, capturing, or destroying spawning-run sea lampreys as they enter streams tributary to the Great Lakes constitute the only means as yet proven effective for controlling the sea amprey. The first year's program is therefore concentrating on that type of structure.

In view of the high construction, maintenance, and operational cost of physical barriers, however, other types of barriers are being investigated. As an adjunct to studies looking toward the development of more effective control methods, laboratory experiments are being performed to discover specific toxicants to destroy larval lampreys with minimum damage to fish.

Research to improve the efficiency of hatcheries has been stressed. Nutrition experiments have resulted in more knowledge about the requirements of trout and salmon. From these studies regular diets have been modified to take care of various vitamin deficiencies and this has resulted in reducing the cost of producing fish. New drugs and chemicals are being tested in an effort to develop new and more adequate prophylactic treatments for hatchery fish. One series of experiments was conducted to determine the amount of various sulfa drugs absorbed by the various parts, organs, and blood of fish. Results indicate that several sulfonamides are not suitable for treatment of various fish diseases. Several new bacterial diseases of trout and salmon have been discovered and methods of treatment are now being worked out.

MAINTAINING THE INLAND FISHERIES

Increased fishing pressure has continued its drain of game fish from inland waters in this country. The growing number of motor vehicles in use, modernization of access roads into remote areas, a vacation-minded public, greater publicity regarding recreational areas, and the increased number and variety of artificial lures used for the taking of game fish are a few of the contributing factors that have made sport fishing a major element in the recreation enjoyed by the American public.

The areas available for natural spawning of game fish have been greatly reduced by continued growth of population in congested areas, depletion of forests by the lumber and pulp industries, pollution of streams, and the construction of great multiple-purpose dams. This situation coupled with fishing pressure, has placed a tremendous strain on existing fish-cultural establishments to provide game fish for restocking purposes. To endeavor to meet this demand, Congress provided funds to begin construction of hatcheries at North Attleboro, Mass.; the Upper Peninsula of Michigan; Millen, Ga.; and Bald Hill Dam, N. Dak.; also for continuing construction of the hatchery at McNenny, S. Dak.; and for enlarging and improving facilities at Lamar, Pa.; Nashua, N. H.; Hagerman, Idaho; and Hot Springs, N. Mex. Special allotments were provided for the enlargement and improvement of fish-cultural facilities at the following hatcheries in the fiscal year 1950: Berlin, N. H.; Bozeman and Ennis, Mont.; Cape Vincent, N. Y.; Corning, Ark.; Dexter, N. Mex.; Erwin, Tenn.; Harrison Lake, Va.; Hebron, Ohio; Leadville, Colo.; Meridian, Miss.; New London, Minn.; Quilcene, Wash.; Tishomingo, Okla.; Warm Springs, Ga.; White Sulphur Springs, W. Va.; and Williams Creek, Ariz. These special allotments were supplemented by $150,000 for the rehabilitation of other hatcheries in need of repairs.

Recognizing the need for an extensive program for the restocking of important fishes in the Great Lakes, Congress provided $3,000 for a survey to obtain data on potential hatchery sites in that area. A lake trout hatchery will be built on Pendill's Creek on the Upper Peninsula of Michigan as a source of fish for experimental stocking; this stocking will be closely correlated with current investigations on the control of the sea lamprey.

Commercial exploitation of Columbia River salmon runs was first undertaken about 1830. Since 1883, this valuable fishery has shown a consistent decline accelerated in recent years by the construction of impassable dams and unscreened irrigation diversions. For many years the Service program in the West has included the propagation of salmon for maintaining the runs, particularly in the Columbia and Sacramento River systems. Large dams that have been completed on these rivers have greatly reduced the spawning areas once available for migrating salmon; proposed dams will further reduce these areas. The salmon runs will be limited to the lower reaches of the river system when dams that have been approved are completed.

After the construction of Grand Coulee Dam, the Service undertook to preserve the upper-river salmon runs by transplanting them to streams that entered the Columbia River below the dam. The return of adult blueback salmon to these streams is now considerably greater than before the construction of Grand Coulee Dam. At Shasta Dam on the Sacramento River, both natural and artificial propagation have been used, but emphasis has been placed upon hatchery operations. This program, too, appears to have been successful, as hatchery-reared stock constitutes approximately 50 percent of the salmon taken by commercial fishermen in the San Francisco Bay area.

McNary dam and other proposed dams on the lower Columbia may cancel, to a great extent, the success of the Grand Coulee stations. To preserve the salmon runs in the Columbia, the Service, in cooperation with the States of Washington and Oregon, has initiated a program which involves the rehabilitation and improvement of existing hatcheries on the lower river, construction of new units, stream improvements to provide natural spawning areas, and construction of fish ladders and screens. Although construction and development are well under way, this program is far behind the building of dams on the Columbia and its tributaries. The Columbia Basin Inter-Agency Committee and the Federal Inter-Agency River Basin Committee, as well as the Fish and Wildlife Service, the Pacific Northwest Field Committee, and the States of Oregon and Washington, are all concerned because of the lag in this program. In order to meet the limits imposed by the dam-construction program, and taking into account the 4- to 6-year life cycles of the anadromous fish, it is necessary that certain parts of the work—particularly those involving removal of obstructions, installation of hatcheries, and the establishment and transplantation of runs—be completed in the earlier years of the project. This necessitates heavier expenditures in the earlier years. The appropriations requirements for the 10-year period were originally estimated to be in the neighborhood of $3,000,000 annually for the first 5 years after the work had started and approximately $1,000,000 annually for the remaining 5 years. Aside from the present serious lag, there is a distinct possibility that this construction program should be still further accelerated because of the recent action by Congress in authorizing the construction of additional dams on the Columbia River.

Demand for legal-sized trout exceeds the production of these fishes, whose value for stocking purposes has been demonstrated in a number of management areas. The current expansion and improvement program will provide facilities for a large increase in hatchery production of these fishes. The great amount of food necessary for the production of large numbers of legal-sized trout and the inflated cost of meat products emphasize the need for further studies on nutrition. Only a few colleges and universities have facilities for this type of work, and few States have been able to undertake such research. For the last 18 years, the Service, in cooperation with the State of New York and Cornell University, has conducted studies on fishery nutrition at Cortland, N. Y. In conjunction with the research on trout diets, a training program for Service personnel is conducted at the Cortland Station. As a result, new methods of fish culture and fishery management are being applied throughout the country. For employees concerned with the rearing of trout and salmon, the Service continued the in-service training program at the station at Leavenworth, Wash.

As early as 1888, efforts were made to propagate Atlantic salmon to assist in maintaining the runs of this valuable species in rivers emptying into the Atlantic Ocean. At that time, the majority of the salmon were released as fry. It is now apparent that great numbers of large fingerling salmon must be reared and released if the species is to be maintained and runs are to be built up to their former importance. In accordance with the recommendations of the salmon committee in the Atlantic salmon-restoration project, the Federal hatchery at Craig Brook, Maine, has been selected to produce the fingerling salmon that are needed for the restoration program. The Craig Brook hatchery is in need of funds for rehabilitation and construction of adequate rearing facilities.

The construction of farm ponds and reservoirs continued to be a major factor in the great demand for warm-water fishes. The value of farm ponds has been proved, and thousands of small reservoirs are now being constructed annually in almost every State east of the Rocky Mountains. Demand for largemouth black bass exceeded production as this species played an important part in pond and lake management. The 1949 production of pondfish equaled the record of the two previous years. Further increases in pondfish production will depend upon the modernization of existing hatcheries and the construction of new units.

In cooperation with the Alabama Polytechnic Institute at Auburn, Ala., the Service continued a program whereby Service personnel receive training in hatchery management and farm-pond inspection and management. A school for Federal fish culturists will be set up at the Marion, Ala., hatchery for training in the most modern techniques in warm-water fish culture.

Close cooperation has been maintained with the States on all phases of propagation and distribution of fishes during the year. This has eliminated duplication of effort, increased service to the public, and contributed to more efficient management practices.

In general, the production of game fish was at a high level during 1949 despite the fact that current fish-food costs were extremely high and that improvement and expansion programs are needed at many of the hatcheries. The following is a summary of the production of Federal hatcheries for the calendar year 1949 (table 1).

TABLE 1.—*Summary of the production of fishes and eggs by Federal hatcheries during the year ended Dec. 31, 1949*

Group	Eggs	Fry	Fingerling	6 inches or over	Total
Largemouth black bass		1, 085, 024	8, 104, 437	13, 162	9, 202, 623
Smallmouth black bass		511, 000	222, 048	3, 540	736, 588
Rock bass			17, 585		17, 585
Warmouth bass			64, 040		64, 040
Striped bass				339	339
Bluegill			33, 302, 234	19, 189	33, 321, 423
Sunfish, red-ear			165, 848	150	165, 998
Sunfish, green			7, 972	500	8, 472
Rainbow trout	12, 019, 833	11, 355	6, 482, 044	702, 009	19, 215, 241
Brook trout	10, 420, 900	81, 425	3, 161, 022	528, 523	14, 191, 870
Brown trout	831, 837		1, 607, 208	165, 025	2, 604, 070
Blackspotted trout	15, 855, 891	1, 764, 000	3, 518, 872	12, 022	21, 150, 785
Lake trout			62, 662	3, 992	66, 654
Steelhead trout			114, 020		114, 020
Channel catfish		27, 200	206, 506	30	233, 736
Catfish			309, 236	11, 769	321, 005
Black crappie			98, 275	5, 777	104, 052
White crappie			3, 865	2, 964	6, 829
Atlantic salmon	42, 480		270, 625	11, 384	324, 489
Chinook salmon	4, 052, 180		40, 427, 718		44, 479, 898
Chum salmon	5, 270, 200	6, 999, 524			12, 269, 724
Sockeye salmon	607, 069		5, 791, 400	2, 390	6, 400, 859
Silver salmon	50, 120		454, 303		504, 423
Sebago salmon		20, 000	36, 200	1, 438	57, 638
Northern pike	5, 524, 000	4, 967, 708	802, 055		11, 293, 763
Walleyed pike		1, 980, 000	289, 100		2, 269, 100
Yellow perch			26, 778	4, 737	31, 515
Grayling	1, 227, 595		500, 000		1, 727, 595
Flounder		545, 871, 000			545, 871, 000
Shad		22, 879, 000			22, 879, 000
Lobster		206, 000			206, 000
Kokanee salmon			480, 873		480, 873
Total	55, 902, 105	586, 403, 236	106, 526, 926	1, 488, 940	750, 321, 207

FEDERAL AID TO STATE PROJECTS FOR THE RESTORATION OF WILDLIFE

An appropriation of $10,378,538.42, the second largest since the inception of the program, was made to finance the Federal aid in wildlife restoration program. The Service approved a record total of 703 projects obligating $11,624,486.50 of Pittman-Robertson funds. The States' 25 percent additional contributions toward financing these projects amounted to $3,874,828.83, resulting in a grand total of $15,499,315.33 for project activities. The balance of the 1950 funds, or $3,873,064.90, will remain available to the States during fiscal year 1951, to finance additional wildlife restoration projects since apportionments are available for a 2-year period.

As of June 30, 1950, 14 States had obligated all or nearly all of the Pittman-Robertson funds allotted to them. A total of $93,821.11

not obligated by certain States within the 2-year period of availability, was transferred to the Migratory Bird Conservation Fund, as provided by the act.

Many of the year's projects were concerned with waterfowl. Kansas started development of water supply and control structures on Cheyenne bottoms, which will eventually provide some 15,000 acres of waterfowl refuge and public shooting grounds. Shallow ponds and boat lanes were built on the 27,000-acre Bayou Meto unit in Arkansas, and plans for the major impoundments were nearing completion. New Jersey completed the Tuckahoe project during the year. Approximately 3,000 acres of salt marsh have been converted to fresh-water ponds over the past 8½ years. Iowa continued its small lake and marsh development program by proceeding with work on nine areas approved last year and initiating developments on six new ones this year. Michigan increased the tempo of dam construction on its waterfowl flooding projects. Wildlife in California will benefit from a quarter of a million dollars' worth of marsh and water development work on six areas extending from the Imperial Unit in the south to Honey Lake and Madeline Plains in the north. Nevada, cooperating with the Fish and Wildlife Service, made a start on the Stillwater Waterfowl area near Fallon. Oregon continued building the dikes that are transforming the Summer Lake alkali flats into excellent habitat for ducks and muskrats. In all, 32 States were carrying on development projects for waterfowl during the year.

Iowa, North Dakota, and Tennessee undertook farm-game habitat improvement programs during the year. Forty States are now engaged in leasing privately owned lands and restoring upland game habitat thereon. Planting of trees and shrubs, herbaceous seeding, and fencing to exclude livestock were principal activities in the program to produce more farm game. To provide badly needed quail food and cover, several million plants and thousands of pounds of lespedeza seeds were distributed to cooperators by nine Southern States. Multiflora rose, the living fence and game cover plant, was used for border plantings by an increasing number of States. Water catchments in arid places were constructed by California, Nevada, Arizona, New Mexico, Hawaii, and Puerto Rico.

Development of State-owned lands for upland game was accelerated as more tracts were acquired. Fencing and range revegetation were major activities on the big-game areas of the West. Bitterbrush reseeding on overbrowsed deer and elk ranges began to show encouraging results in Washington and Idaho. Forest game received benefits from habitat improvement projects on many of the National and State forests.

Trapping and transplanting to stock-depleted ranges and to effect a more equitable distribution of animal populations was undertaken by 29 States, the Virgin Islands, and Hawaii. This resulted in large numbers of antelope, deer, bighorn sheep, beavers, wild turkeys, grouse, ringnecked pheasants, quail, and Chukar partridges being released on new ranges.

Twenty-three percent of all Pittman-Robertson funds were used o acquire wildlife lands in 101 areas in 33 States. This involved the purchase of 196,279 acres and the lease of an additional 123,109 acres for periods of from 1 to 10 years.

During the year, 19 percent of available Federal-aid funds were invested in 202 game survey and investigation projects correlated with the determination of hunting-season regulations. Through tagging studies and coordinated aerial and ground observations, the Western States have worked out seasonal movements and range boundaries as well as size and composition of big-game herds in sufficient detail to manage these species on a unit or watershed basis. The harvest of surplus animals and adjustment of animal numbers to the supporting capacity of the range can be regulated with a degree of accuracy heretofore impossible.

Game specialists have become increasingly apprehensive of the use by agriculturalists of modern herbicides and insecticides because of the direct or secondary effect these chemicals may have on game. Wyoming undertook an exhaustive study of two grasshopper poisons—Chlordane and Toxaphene—which are distributed in large quantities in that State, and Michigan investigated the effects of the weed killer 2,4–D.

Arizona made a field study of use being made of numerous catchments built in arid ranges with Federal-aid funds, to supply water for game birds. Lack of year-round water was known to be the reason that flourishing bird populations had not been maintained. During July and August of 1949, an average of 114 Gambel's quail were using each rain-water-collecting installation.

California found that the valley quail were restricted in numbers not only by a lack of water in scant-rainfall localities but also by a shortage of the special type of roosting cover this species requires. The State designed and tested an artificial roost constructed of iron pipe and brush which holds promise of alleviating this defect.

As visible evidence of progress in adding to the knowledge of requirements and management technics for wildlife, the States and Territories published 330 articles and bulletins based on project findings.

During the year, the Service's Branch of Lands examined and appraised 105 projects under the program, comprising 481,978 acres. Cover type maps and appraisal reports were prepared for each. These projects, located in 38 different States, had a total appraised value of $6,437,000 and appraisal reports were prepared for each of the 665 individual ownerships involved.

THE NATIONAL WILDLIFE REFUGE PROGRAM

The critical plight of the waterfowl and other endangered species of wildlife in the 1930's required that every means be taken to protect wildlife from further reduction or extinction. General recognition of the problem brought widespread public support for extension of the national wildlife refuge program begun early in the century. This work was greatly accelerated through the transfer of special funds and the passage in 1934 of the Migratory Bird Hunting Stamp Act. The small nucleus of approximately 100 areas under administration in 1930 has now grown to a system of 282 refuges for waterfowl and other species, including big game, that encompasses nearly 18,000,000 acres in the United States and Territories.

Cost of development and operation increased so rapidly that funds available from the migratory bird hunting stamp for land acquisition were critically reduced. During 1949 the act was amended to provide greater revenue by increasing cost of the stamp from $1 to $2, and the Service was authorized to open not to exceed 25 percent of any newly acquired refuge for regulated public shooting after development has been completed and waterfowl populations warrant. Funds accruing from the sale of the new waterfowl stamps are not available until fiscal year 1951. In the future, new waterfowl areas will be acquired throughout the country at critical concentration points where land costs permit but emphasis must be placed also on proper development of existing refuges.

Favorable wildlife response to conditions created by management on artificial areas, many of which have been developed in connection with irrigation, hydoelectric, or flood control impoundments, indicate a possible solution of one phase of the problem. The waterfowl increases on both breeding and wintering refuges of this type have been spectacular and phenomenal. The Crab Orchard National Wildlife Refuge, Illinois, had a wintering population of 486 geese and 1,600 ducks in 1946. Three years later a count revealed 40,000 geese and 184,000 ducks. Bowdoin National Wildlife Refuge in Montana, a multiple-purpose waterfowl refuge, has shown consistently steady gains, from 2,000 geese and 40,000 ducks in 1942 to 6,000 geese and 177,000 ducks for the same 3-month period in 1949. Wintering refuges in other sections of the country provide similar examples. On the Lacassine National Wildlife Refuge, Louisiana, an artificial wintering area, waterfowl increased from 3,400 geese and 45,500 ducks in 1942 to 40,000 geese and 191,000 ducks during the same period.

The farming program accomplished largely by sharecropping land and leaving the rental portion in the fields for waterfowl has been the chief means of increasing the wintering duck and goose population on the refuges. Standing grains left in the refuge fields are now being completely utilized. The Service, during the calendar year 1949, had approximately 48,983 acres of refuge land under cultivation by private individuals or refuge personnel. These operations brought a return of 545,934 bushels of grain to 620 cooperative farmers and provided in addition to the green forage an estimated 320,984 bushels of grain to the Government which were either harvested or left in the field for wildlife. In grazing and haying operations carried out during 1949, 394 farmers cut 14,056 tons of hay from 36,681 acres, and 1,057,434 acres provided 351,341 animal-unit months of grazing for 726 permittees, plus a substantial cash return to the Government.

Urgent management problems exist in various sections of the country wherever food production on the refuges has not adequately provided for heavy concentration of birds. Production of food for waterfowl has been increased on the Salton Sea, Colusa, and Sutter National Wildlife Refuges in California, and provisions have been made for intensified farming activities on other refuges along the Pacific flyway. The critical situation along this major migratory route should diminish as progress continues under the California waterfowl management program (Lea Act), a joint endeavor of the Service and the State of California. Obviously, the largest possible food production on refuge lands is necessary to meet wildlife requirements and to prevent damage to farm crops on private land. Some of the refuge land now being farmed, producing only 25 bushels of corn or 10 bushels of grain, has, with good land-use practices, a potential production of 65 bushels of corn or 25 bushels of small grain. There is also a large acreage of depleted or eroded land which can be restored to profitable production for the local farmer and for wildlife through the application of a good land-use program. The Service, during the past year, has just completed comprehensive soil and moisture plans of operation for each refuge and is presently engaged in classifying the land in accordance with its capabilities as a means to better land utilization. Cooperative agreements with local soil-conservation districts have been extended during the past year and the program has been implemented by technical or other assistance through this medium. The Solicitor of the Department of Agriculture has recently ruled that croplands on national wildlife refuges operated by farmers as sharecroppers under permit are eligible for payment for conservation practices under the agricultural conservation program administered by the Production and Marketing Administration.

During 1949, chemical control of weeds was practiced on nine national wildlife refuges. By careful use of this method waterfowl food plants have been increased and nesting habitat has been improved by the eradication of pest plant growths and the substitution of desirable vegetation. Acquisition of modern equipment has aided control of forest fires and protection of wildlife habitat, timber, and other resources.

Economic uses which contribute to the local economy and are not inconsistent with the primary objectives of wildlife management are encouraged on the national wildlife refuges. Forest management practiced for habitat improvement resulted in the removal from refuge lands of 5,193,260 board feet of sawlogs, 4,983 cords of pulpwood, and 4,975 ties and posts during 1949. More than 2,029 individuals cooperated with the Service and participated in the economic use program under special use permit. The revenue resulting from the program, including the sales of furs, surplus big-game animals, or other products of the land, amounted to approximately $439,000. The law provides that 25 percent of the receipts from each refuge shall be returned by the U. S. Treasury to each of the counties in which they are located. Under this provision $109,750 was made available to county governments for the improvement of schools or roads.

Variable conditions prevailed on the four fenced big-game preserves maintained by the Service. A severe drought at the National Bison Range, Montana, necessitated a substantially increased disposal program of surplus animals to protect the range. Optimum conditions prevailed at the other three projects with the result that the herd totals remain about the same as the previous year, as is shown in table 2.

TABLE 2.—*Number of animals on fenced big-game preserves maintained by the Fish and Wildlife Service*

ANIMALS AS OF JUNE 30, 1950

Refuge	Buffalo	Elk	Deer		Texas longhorn	Mountain sheep	Antelope	Total
			White-tailed	Mule				
National Bison Range, Montana	483	102	116	438		16		1,155
Fort Niobrara National Wildlife Refuge, Nebraska	200	46			132			398
Sullys Hill National Game Preserve, North Dakota	20	19	17					56
Wichita Mountains Wildlife Refuge, Oklahoma	798	265	720		294		63	2,140
Total	1,521	432	853	438	426	16	63	3,749

YOUNG BORN IN CALENDAR YEAR 1949

Refuge	Buffalo	Elk	Deer		Texas longhorn	Mountain sheep	Antelope	Total
			White-tailed	Mule				
National Bison Range, Montana	167	[1] 21	[1] 12	[1] 100				300
Fort Niobrara National Wildlife Refuge, Nebraska	52	[1] 15			29			96
Sullys Hill National Game Preserve, North Dakota	7	6	7					20
Wichita Mountains Wildlife Refuge, Oklahoma	156	[1] 75	[1] 100		74		22	427
Total	382	117	119	100	103		22	843

[1] Estimated.

At the Aransas National Wildlife Refuge, Austwell, Tex., a pair of captive whooping cranes—2 of the 37 birds remaining—nested during the spring of 1950. Incubation of the egg apparently began on April 22, and thereafter constant daylight vigilance and observation from a 20-foot tower were maintained over the nest on a salt grass flat located within a 150-acre fenced enclosure. The chick was hatched on May 25, after an incubation period of approximately 33 days. This was the first known successful attempt to breed whooping cranes in captivity, and it is regrettable that the venture, which gave every promise for success, ended in failure. The chick disappeared 3 days after hatching. The cause of loss could not be definitely established.

Legislation was introduced in the Congress in fiscal year 1950 authorizing the establishment of a wildlife management area on the Florida Keys. A small group of subtropical islands about a hundred miles south of the Florida mainland is the last retreat of the diminutive key deer, the smallest of its kind in the United States. This unique animal formerly ranged over most of the keys between Key Largo and Key West, but is now restricted to Big Pine Key and a few adjacent islands as a result of tourist traffic and commercial developments. Its numbers, which have never been large and were estimated at 70 head in 1947, have been further reduced until possibly not more than 25 remain, and these face a precarious existence. The deer have persisted on the limited habitat of the keys despite increasing obstacles, but immediate provision must be made for their survival if the species is to endure. The proposed legislation has the wholehearted support of national conservation organizations and public-spirited individuals who recognize that the species is on the verge of extinction.

The Service on July 1, 1949, relinquished secondary jurisdiction in the administration of the 658,618-acre Boulder Canyon National Wildlife Refuge on the Boulder reclamation project in Nevada and Arizona, since adequate protection of wildlife is afforded in the National Park Services' demonstration area.

The 1,588-acre Wilson National Wildlife Refuge, Georgia, secured originally by gift, was returned to the former owner by act of Congress, August 16, 1949. Execution of a cooperative agreement by the Jicarilla Tribal Council, the Bureau of Indian Affairs, and the Fish and Wildlife Service providing for the rehabilitation of lakes on the Jicarilla Apache Reservation, N. Mex., marks another milestone in conservation. Under the program now being carried out former waterfowl nesting habitat is being restored to a productive level and extensive plantings are in process to increase the supply of natural food for migrant ducks and geese.

TABLE 3.—*Acreage acquired or in process of acquisition for National wildlife refuges under the Migratory Bird Conservation Act and by exchange and act of Congress—Fiscal year 1950*

State	Refuge	Acquired other than by purchase	Purchased under Migratory Bird Conservation Act	Total acquired	Pending title conveyance
California	Colusa		1,095	1,095	
Do	Lower Klamath		532	532	
Florida	Chassahowitzka				2,786
Georgia	Blackbeard Island				954
Do	Okefenokee	1,906	253	2,159	
Do	Piedmont				2,146
Iowa	Union Slough		64	64	34
Kentucky	Kentucky Woodlands	100		100	122
Maine	Moosehorn				243
Maryland	Blackwater				434
Minnesota	Tamarac				2
Missouri	Mingo		647	647	2,104
Do	Swan Lake				88
Nebraska	Crescent Lake				2,560
Do	Valentine	704		704	1,104
New Jersey	Brigantine				789
New Mexico	Bosque del Apache				1,048
New York	Wertheim				22
North Carolina	Mattamuskeet		16	16	
North Dakota	Lake Zahl				640
Do	Lostwood		80	80	
Do	Lower Souris		6	6	1
Do	Upper Souris	221		221	5
Oklahoma	Salt Plains				551
Oregon	Malheur				4,680
South Carolina	Carolina Sandhills				50
Texas	Laguna Atascosa		18,997	18,997	
Vermont	Missisquoi				128
Virginia	Chincoteague				138
Washington	Little Pend Oreille				1,160
Do	Skagit		2,351	2,351	
Do	Turnbull		462	462	14
Do	Willapa		21	21	
Wisconsin	Horicon		80	80	1,207
Do	Necedah		80	80	
Total		2,931	24,684	27,615	23,010

RIVER BASIN DEVELOPMENTS AND WILDLIFE NEEDS

Federal programs of river-basin development in 1950 demanded increased activity by the Office of River Basin Studies and resulted in a continuing series of project reports by the Service during the year. Reports have been completed on 12 important representative river basins on which departmental reports were requested by the President's Water Resources Policy Commission. These detailed statements covered existing fish and wildlife resources, Service properties, such as hatcheries and wildlife refuges, water developments, the impact of dams and diversions constructed by Federal and private agencies on fish and wildlife, and problems arising from conflicts between fish and wildlife interests and those concerned with flood control, drainage, power, and navigation. Investigators in the Dakotas and Minnesota interviewed farmers and Soil Conservation Service district supervisors and Production and Marketing Administration representatives in a study undertaken to develop, if possible, measures to preserve marshes that are essential to waterfowl and other wildlife of the country. Federal subsidization of farmers has resulted in many marsh and pot-hole drainage projects involving waterfowl nesting areas.

The first of a series of projects to restore wildlife on water-utilization developments in the Missouri River Basin were initiated during the year at three Bureau of Reclamation reservoirs now in their final stages of construction. The first planting of vegetative cover was started on the Angostura Reservoir in South Dakota with the coming of spring weather and similar work was initiated on the Enders and Medicine Creek Reservoirs in Nebraska's Republican River Basin. In addition, the first 2 of more than 60 wildlife habitat projects on the Fort Randall Reservoir of the Corps of Engineers in South Dakota were started in the spring of 1950. These plantings will range in size from 5 to 13 acres and will total about 575 acres scattered along both sides of the 154-mile-long reservoir.

During the fiscal year 1950, the Office of River Basin Studies completed 205 reports on water-use projects. Of this total of 205 reports, 118 were made for the Corps of Engineers, 39 for the Bureau of Reclamation, 2 for the Soil Conservation Service, and 46 reports were prepared for the Federal Power Commission on public and private water-power projects licensed by the Commission. The Service's reports contain recommendations which, if adopted, will lessen damage to fish and wildlife resources and, in many cases, result in enhancing these resources.

RESEARCH IN WILDLIFE MANAGEMENT

The 1950 winter waterfowl inventory conducted in Alaska, Canada, the United States, Mexico, and the West Indies gave evidence that the continental population of wintering waterfowl had again declined. The trend point was 25 percent lower than that of the previous winter. Increases, in varying degrees were apparent in several groups of waterfowl for certain flyways: Among brant in both Atlantic and Pacific flyways, ducks in the Central and Atlantic fiyways, and swans in the Pacific flyway.

Although hunting-season bag checks showed a general decrease in the number of hunters in all flyways of the United States, an increase in the seasonal kill of ducks per hunter resulted in about a 6-percent increase in the total legal harvest.

On waterfowl breeding grounds in 1949 the numbers of breeding birds increased slightly but actual production of young was considerably below the potential. A summary of results of the investigations in Alaska, Canada, and 22 States was published in a special report.

Summer breeding ground surveys for 1950 in Alaska, Canada, and the United States, were under way at the close of the fiscal year. Early season reports showed reduced breeding populations in a number of important sections, but climatic and other conditions affecting the production of young were better than in 1949.

Because of the particular need for information on the status of breeding populations of mourning doves which migrate into the Southeastern States, where they are intensively hunted during the fall and winter, new methods of appraising abundance were tested. A better method was also developed for censusing clapper rails during the nesting season, and this popular game bird of the tidal marshes was studied intensively in its important breeding area on the coast of Virginia.

The banding of North American birds was intensified and reached a postwar high due to emphasis on the use of this medium in the study of the migration of waterfowl, and particularly as a result of increases in State-sponsored banding projects under the Federal aid program. Almost 350,000 birds were banded during the year and 23,000 banded birds were recovered.

Fur-seal investigations were resumed in Japan during the spring and completed by the end of the year. A report on the work is in progress. On the Pribilof Islands, research continued to develop better techniques and methods for estimating and computing the size of the fur-seal herd. Metal tags for identification were attached to the flippers of 20,000 fur-seal pups.

Cooperative wildlife research units were established in Alaska and Montana during the year and authorization was obtained for units in Arizona and North Carolina which would bring to 18 the number of these cooperative projects in which the Fish and Wildlife Service, the Wildlife Management Institute, and the respective land-grant colleges and State conservation departments participate. Approximately 100 technical papers, bulletins, and popular articles were published on wildlife-research findings of unit personnel. Since the inception of the cooperative unit program in 1935, approximately 1,600 such publications have appeared.

Work completed during the year in the Biological Surveys Section includes published contributions on the coyote, puma, and American bison, a report (in press) resulting from the extensive work of the late E. A. Goldman in Mexico, and a study (in press) of the raccoons of North and Middle America. The facilities of the mammal laboratory were utilized by 50 research workers and visitors.

In the country as a whole, little research is being done on wildlife-disease problems, but, through the appointment of a pathologist during the year, the Service acquired the means of investigating emergencies. Information on incidence, effects, and control methods are needed for a wide variety of wildlife diseases, including botulism and fowl cholera in waterfowl, tularemia in various birds and mammals, screw worm and other parasites of deer, hemorrhagic septicemia in big game, fungus disease in muskrats, and others.

Investigations of management methods for agricultural wildlife are proceeding at the Patuxent research refuge in Maryland and in the Southeast. This research has already indicated that only a limited list of woody plants are sufficiently dependable to be recommended to farmers. Field borders, contour hedges, and living fences of multiflora rose are practicable ways to provide wildlife cover in a modern farming program, but methods of establishment must be adapted to site and region if a large proportion of failures is to be avoided. Work in Alabama indicates that modern farming practices featuring grass and legumes are more favorable to quail than the older, cotton and corn type of agriculture.

In cooperation with the Bureau of Entomology and Plant Quarantine, investigations of the effects of DDT spraying for control of Dutch elm disease were conducted at Princeton, N. J. It was determined last year that significant losses to songbirds may occur when spraying is done during the nesting season. In an effort to minimize such losses, spraying operations in 1950 were carried out prior to the breeding season. It was found, however, that losses were even greater during the early spring spraying, and further efforts are being made to modify the spraying program to reduce damage to bird life.

Large operational programs for the control of mosquitoes in salt marshes are under way on the Atlantic seaboard. Preliminary experimental tests indicate that losses to blue crabs and other valuable wildlife may occur when dosages greater than 0.2 pound per acre are applied from airplanes. Further work in progress should lead to recommendations of methods to accomplish the desired control of mosquitoes with minimum damage to other species. The main concern in these low-dosage applications is the possible adverse effect of the chemical on important animal foods of wildlife.

The summer of 1949 marked the completion, at Patuxent, of a 5-year study on the animal life of a forest area sprayed annually with 2 pounds of DDT per acre. By the fifth spring breeding bird populations had declined 26 percent. Other representative animals, such as the wood mouse and box turtle, showed no change in population. Early experiments on another tract sprayed at the rate of 3 pounds of DDT per acre have been carried out to determine the effect of such application on the growth and survival of nesting birds. For certain species, nestling mortality amounted to approximately 50 percent in

1949. Laboratory tests on the toxicity of DDT have been made on starlings, pigeons, quail, and pheasants. Findings thus far indicate that the pheasant is far more susceptible to this poison than the other species tested. Further investigations will determine the feasibility of using chemical analysis of tissue as a means of diagnosing lethal DDT poisoning in birds.

Continental waterfowl populations are directly dependent upon the marsh and other acquatic habitats now remaining. An important field of management is the improvement of these areas by methods that will encourage vegetation of greatest value. Studies in TVA impoundments on the use of herbicides to bring about beneficial plant successions have been carried out for several years. A recent report has been published summarizing information on the use of ammate and 2,4–D in the various situations found in these areas.

Progress can be reported on management experiments for waterfowl on two acid-water impoundments at the Patuxent Research Refuge. The manipulation of water levels appears to be a means of greatly increasing natural food supplies and making such dark, relatively sterile, lakes attractive to migrating birds. Such bodies of water are common on the North Atlantic seaboard and effective methods should have wide application where water levels are under control.

COOPERATIVE CONTROL OF PREDATORS AND RODENTS

Reduction of economic losses caused by destructive forms of wildlife was aided during the year by the greater application of improved techniques which permitted highly selective and more efficient control of undesirable species. Consequently, there were somewhat fewer instances of extensive losses to crops and livestock than in former years. There were also direct savings in desirable forms of wildlife, particularly among upland game, birds, deer, and antelope.

Control activities were largely conducted under supervision or guidance of trained biologists of the Service in cooperation with local agencies. Selective control was attained by a variety of methods which included the careful application of lethal agents in specific isolated areas known to be infested with destructive predators but unfrequented by game and furbearers. Potential hazard to animals such as mink and marten, for example, was largely prevented by avoiding placement of lethal stations in or adjacent to timber or along streams. Danger of accidental poisoning was further reduced by shallow burial of baits and by the use of material, such as seal blubber, which is unattractive to some furbearers, but readily accepted by wolves or coyotes. The distribution, in carefully selected places, of certain type baits and control devices during winter months similarly avoided danger to herbiverous big-game animals or hibernating bears, but permitted removal of wide-ranging wolves and coyotes with minimum detrimental effect upon foxes and other short-ranging carnivora. The shooting of wolves and coyotes from the air frequently permitted their destruction within a few hours after their depredations were reported by farmers or ranchers.

Successful application of selective control techniques was likewise practiced in the eradication of injurious rodents. Bird-repellent green or yellow dyes were applied to grain baits, and poison formulas were employed which destroyed rodents but did not contain amounts lethal to most other wildlife. Further selectivity was attained by a choice of baits unattractive to some species of birds and animals and by careful placement of such materials in concealed locations frequented by rodents only. The art of selective control for objectionable species is still in its infancy but already promises to be an extremely valuable tool for wildlife management. Its importance will grow with increased demands of civilization and correspondingly greater inroads of agricultural activities into habitats occupied by wildlife.

Postwar development of various control devices and materials continued at an accelerated pace, but because of potential hazards their proper application required extensive training and instruction of field personnel. This was largely accomplished by hunter conferences conducted throughout the Western States during fall months and by discussion among those in charge of control activities. Service findings and recommendations covering many aspects of wildlife control were embodied in several publications, including a standard operating procedure for safe use of the chemical known as Compound 1080; findings on experimental use of the new rodenticide, warfarin (3-alpha acetonylbenzyl-4-hydropy-coumarin); and also a policy statement relative to wildlife control practices on public lands, prepared in cooperation with the Forest Service.

Operational efficiency was materially increased by improved control methods and to some extent served to offset partially the higher costs for labor and materials. This factor, combined with expenditures of about $4 in cooperative money for each dollar of Federal funds, made possible the generally adequate control of predatory animals on privately owned land in the West where cooperative projects could be organized. Unfortunately, however, available manpower was spread so thin that relatively little control work could be carried out in some areas of public domain and in rural areas where community efforts remained unorganized. Predators drifting from such breeding grounds to adjacent farms and ranches marred the degree of control otherwise attained. Likewise, only token rodent control work in these localities was possible.

For the first time in history, satisfactory mole control was attained in portions of Oregon, and this State was also a proving ground for a technique that promises effective control of tree-seed-eating mice which have long hampered the reforestation of logged and burned-over forest areas. In other States experimental application of the new rodenticide, warfarin, proved highly effective against rats and house mice, thus providing an additional weapon for combating the tremendous losses caused by these.

Intensified predator control operations were continued in Alaska where, contrary to common belief, a teeming abundance of big game animals does not exist. At the present time herds of caribou, mountain sheep, and semi-domesticated reindeer are seriously decimated and in need of all possible protection. In many instances the situation is critical and their numbers can be increased only by placing limitations upon the human take and by reducing losses through predation. The Service's program is directed toward preventing excessive kills of all kinds among game herds in these areas. The removal of predators is handicappd because of remoteness of ranges inhabited by such game herds and also by climatic and transportation difficulties. However, efforts to protect the Melchina caribou herd, which totals about 4,000 animals, were outstandingly successful. During the past year more than 60 wolves have been removed from the range occupied by this small herd. Such reduction of predators should materially aid the survival of both young and adult caribou in this area.

Technical assistance and information concerning control practices were provided many foreign countries, particularly Italy, England, Sweden, Australia, the Philippine Islands, Canada, Mexico, and several South American republics. Representatives from several Canadian provinces visited projects in the Dakotas, Montana, and Colorado to learn methods, techniques, and safety precautions practiced by the Service. Demonstrations of modern control methods were conducted for Mexican ranchers in cooperation with the Mexican Government and the Pan-American Sanitary Bureau. During the year studies were also made along the border in cooperation with the Department of Agriculture to determine movements of wildlife capable of transmitting hoof and mouth disease.

Events of the year included a number of problems which could not be satisfactorily solved. Widespread epidemics of rabies in wildlife continued in New York, Pennsylvania, and New Jersey as well as in several Southeastern States, while further eruptions took place in east Texas, Arkansas, and southern California. Although effort was exerted to remove rabid coyotes and foxes, epidemics frequently exceeded available facilities to prevent further spread of the disease and resulting livestock losses totaled many hundreds of thousands of dollars. Tree-girdling mice also took their toll of fruit trees; and reports from Michigan, Wisconsin, and Washington indicated severe injury during the past winter. The orchardists are in particular need of more economical methods as well as improvements in techniques for the control of pine mice. This latter rodent is now considered the No. 1 enemy of fruit growers throughout a wide area extending from Connecticut south to Georgia and westward to Missouri, the problem being particularly acute in Virginia.

Financial expenditures for control operations totaled $4,567,708.00 of which $1,237,139.00 was contributed by States and $2,293,914.00 by counties, cities, livestock associations, and other cooperating groups or agencies. Federal appropriations in the amount of $1,036,655.00 were largely expended in demonstrating techniques and supervising activities.

The recorded catch of predatory animals included 66,281 coyotes, 1,159 wolves, 10,874 bobcats and lynxes, 753 stock-killing bears, and 236 mountain lions. In rodent control operations 12,159,797 acres of land were treated for the elimination of prairie dogs, ground squirrels, pocket gophers, jack rabbits, field mice, cotton rats, kangaroo rats, porcupines, woodchucks, and moles. In addition 451,187 premises were treated in cooperative campaigns for the control of house rats. Special equipment and supplies used in predator and rodent control, and 509,404 pounds of rodent bait materials were distributed to cooperators throughout the country by the supply depot at Pocatello, Idaho.

INTERNATIONAL COOPERATION IN CONSERVATION

INTERNATIONAL CONSERVATION AGREEMENTS

During the past year, the Fish and Wildlife Service has assumed added responsibilities for collaboration with the Department of State in the drafting and negotiation of international conservation agreements and implementing legislation, in preparing diplomatic correspondence relative to such agreements, and in carrying out certain functions in connection with existing agreements.

The International Convention for the Northwest Atlantic Fisheries, concluded at Washington on February 8, 1949, has been ratified by 4 of the 11 signatory countries, the United States, the United Kingdom, Iceland, and Canada, and entered into force on July 3, 1950.

The Convention Between the United States and Mexico for the Establishment of an International Commission for the Scientific Investigation of Tuna, signed at Mexico City, January 25, 1949, has not as yet entered into force. Domestic action toward ratification has been taken by both countries, but the formal exchange of ratifications has not as yet been effected.

The Convention Between the United States and Costa Rica for the Establishment of an Inter-American Tropical Tuna Commission, signed at Washington, May 31, 1949, entered into force on March 3, 1950. The President has appointed the following three United States members: M. C. James, Assistant Director, Fish and Wildlife Service; Lee Payne, member of the California Fish and Game Commission; and Eugene D. Bennett, attorney, of San Francisco. The first commission meeting will be held at San Diego, Calif., in July 1950. The agreement is open to adherence by other interested governments.

On June 27, 1950, the Senate gave its consent to ratification of the Convention Between the United States and Canada for the Extension of Port Privileges to Halibut Fishing Vessels on the Pacific Coasts of the United States and Canada, signed at Ottawa on March 24, 1950. It is constantly expected that the convention will be ratified and enter into force in July 1950.

INTERNATIONAL TECHNICAL COOPERATION

The Fish and Wildlife Service continued to give assistance to other American Republics under the program of the Interdepartmental Committee for Scientific and Cultural Cooperation. Because of the many interests and problems common to Mexico and the United States, the fishery mission to Mexico has continued in force since 1942. Early in 1949, on request of the Government of Peru, and in cooperation with the Institute for Inter-American Affairs, the Service sent a short-term mission to Peru to assist in solving numerous problems concerned with administration and management of fish and wildlife resources. In September, the mission was reactivated, and the staff increased by the addition of a fishery technologist and an expert in the management of the fisheries of inland waters. Gratifying progress has been made in attaining the objectives of the project. A large fish terminal is nearing completion in Lima; an experimental technological laboratory at Callao has been completed and staffed; sanitation standards for fishery products established and promulgated; and a management plan for inland waters formulated.

In June 1950, the Fish and Wildlife Service cooperated with the Office of Foreign Agricultural Relations of the Department of Agriculture in carrying out a survey of existing and potential markets in Latin America for United States fishery products, particularly canned fish.

The program of training qualified students of foreign countries in several phases of biological science and management in relation to conservation was continued during the war. Only two students were in residence, but preliminary arrangements were made for several others to start training in the near future. The Service again cooperated with the Department of State in making arrangements for visits of foreign specialists and professors to the United States.

Rehabilitation of Philippine Fisheries

The Philippine fishery program, authorized by the Philippine Rehabilitation Act of 1946, was terminated on June 30, 1950, in accordance with provisions of law. As some of the objectives of the program were designed to get up basic data upon which the Nation could build a sound fishery management plan, there were, of necessity, long-range studies that obviously could not be completed in the time allotted by the act. This condition required close cooperation with the Philippine Bureau of Fisheries so that these studies could be continued after termination of the United States mission. The most important of the long-range projects were the fundamental investigations in oceanography, fishery biology, and ecology.

In addition to the long-term investigational projects, there was need for immediate rehabilitation projects to increase the current food supplies. These projects consisted of exploratory fishing to open new fishing grounds, the introduction of new and more effective gear, modern fishing preservation practices, and experiments in the development of byproducts.

Through the medium of news releases, information leaflets, demonstrations, and personal contacts, it was possible to secure immediate results in increasing supplies of fresh-fish products to provide urgently needed proteins. It is estimated that, from a low of less than 1½ ounces of animal protein per person per day at the beginning of the program, the amount nearly doubled and was approaching the point of meeting standard nutritional requirements at the close of the program.

The long-range projects have provided the Philippine Bureau of Fisheries with a knowledge of the basic pattern of the oceanography and fishery biology of the waters of the Philippines and adjacent seas, which will be invaluable in the Bureau's study of populations and migrations as a basis for formulation of a sound fishery management policy.

Of the 125 trainees selected by competitive examinations for 1 year of training in the United States, 83 have completed training, and are now employed either in the fishing industry or by the Philippine Bureau of Fisheries, where they are making a substantial contribution to the rehabilitation of the fisheries. The remaining 42 are expected to return to the Philippines before October 1950. In addition to these trainees, a number of student-apprentices of the Philippine Institute of Fishery Technology were trained in the Philippines by employment aboard vessels or in laboratories and pilot plants of the program, where they worked under direct supervision of technicians of the United States.

During the existence of the program, more than 30 publications of scientific and popular interest were prepared and distributed. One hundred press releases on the work of the mission were issued, and these were printed by outstanding newspapers and magazines, many translated into the several dialects. So well received was the work of the program as evidenced by these publications that the Newswriters Association of the Philippines, an organization of editors and feature writers, cited the Philippine fishery program of the Fish and Wildlife Service as the outstanding marine development of the industries of the Philippines during the calendar year 1949.

Largely through the work of the program, the Philippine Bureau of Fisheries grew from a small division of one of the departments to a full-fledged bureau of the Department of Agriculture and Natural Resources, and was recognized by increased appropriations as one of the major factors in food production. With the close of the program on June 30, most of the equipment was transferred to the Philippine Bureau of Fisheries, where it is being used to carry on projects initiated by the United States mission. Although the Philippine Bureau of Fisheries is ably administered, and is manned by trained personnel, there is urgent need for continued assistance by technical advisers from the United States.

The International Whaling Commission will hold its second annual meeting at Oslo, Norway, in July 1950. The following additional countries have become parties to the 1946 convention and consequently members of the Commission: Brazil, Denmark, Mexico, New Zealand, and Panama. The Commission will review current information concerning the stocks of whales, and consider the need for changes in regulations concerning capture and utilization during the next season. The United States will be represented at the meeting by an official delegation of three persons.

ADMINISTRATION OF FEDERAL STATUTES FOR PROTECTION OF FISH AND WILDLIFE

Of the many statutes administered by the Service for the protection of fish and wildlife, which are enforced by six regional supervisors of law enforcement and ninety-four agents in the United States and Territory of Alaska, the principal ones are the Migratory Bird Treaty Act, Migratory Bird Conservation Act, Migratory Bird Hunting Stamp Act, Lacey Act, Black Bass Act, Bald Eagle Act, the Alaska game law, laws protecting wildlife and property on Federal refuges, and those pertaining to commercial fisheries in Alaska.

In addition to the enforcement of the above-mentioned laws and regulations thereunder, all agents of the Service cooperate with officers of other Federal and State agencies and collect data essential to sound game management. At times, and in some agricultural areas, United States game management agents assist in dispersing and controlling migratory birds that concentrate in such areas and seriously threaten valuable farm crops. Those agents, also, participate in making annual winter estimates of migratory game bird populations and report on nesting conditions, breeding, and brood populations

At the end of the fiscal year the following migratory-bird permits were outstanding: For propagating, 3,982; scientific collecting, 2,528; scientific possession, 670; scientific possession (special), 3,642; bird banding, 2,897.

Migratory-bird permits issued during the fiscal year were as follows: For propagating, 670 (last year, 356); scientific collecting, 423 (last year, 323); taking for propagation, 14 (last year, 24); bird banding, 172.

Permits issued by the regional directors to control migratory birds that threatened valuable agriculture crops were as follows: To kill migratory birds, 387; to herd with use of pyrotechnics, 348; to herd with use of airplane, 17.

Among the Migratory Bird Treaty Act offenses prosecuted in Federal court were the following: Two Virginia hunters attempted to capture wild ducks by means of traps and also threatened to assault the agent. One was fined $250 with 3-month jail sentence; the other, $500 with 6-month jail sentence. In Missouri two defendants charged with hunting, killing and possessing wild ducks in closed season were fined $750 each. Four others similarly charged were fined $200 each in addition to jail sentences of 30 days.

The drive against persons trafficking in waterfowl in California was continued. One duck seller, found guilty by a jury, was sentenced to serve 45 days on each of three counts. Two persons who purchased ducks and possessed excess limits were fined $400 each; in addition, one was sentenced to 6 months in jail. Found guilty by a jury on the charge of possessing and transporting over 200 ducks, a defendant was fined $500 and placed on probation for 5 years. Another who pleaded guilty to killing, possessing and transporting more than 200 ducks was fined $500, given a 6 months' suspended jail sentence, and placed on probation for 2 years. A jury returned a verdict of not guilty in six other cases involving the sale of ducks. Other cases obtained during joint operations by State and Federal officers relating to the purchase of ducks were successfully concluded in State court, as follows: $100 each, 7; $300 each, 3; $50 each, 2; 60-day sentence suspended, 1.

An agent and 11 State officers, acting upon information that violations were likely to occur on May 6, 1950, off Cape Lookout, N. C., took up their stations at 4:00 a. m. They observed several boats come in filled with hunters, who proceeded to hunt and kill loons from 4:40 a. m. to 5:00 a. m. More than 60 persons were apprehended and have been filed on in Federal court.

Following a joint investigation by State and Federal agents, evidence was obtained against a fish operator in Washington involving the illegal taking and possession of halibut in closed season, giving misleading information, and failing to pay a privilege tax. Pleading guilty in State court on July 6, 1949, the defendant was fined $3.000 and costs.

TABLE 4.—*Summary of penalties imposed during the year for violations of wildlife conservation laws, 1949–50*

Act	Convictions	Fines and costs	Jail sentences
			Days
Migratory Bird Treaty Act	510	$34, 471. 57	1, 115
Migratory Bird Conservation Act	40	1, 880. 00	
Migratory Bird Hunting Stamp Act	58	2, 416. 00	
Black Bass Act	1	25. 00	
Upper Mississippi River Refuge Act	1	25. 00	
State prosecution from Lacey Act investigations	10	330. 00	
State laws, cooperative prosecutions	2, 245	78, 077. 90	511
Total	2, 865	117, 225. 47	1, 626

TABLE 5.—*Cases of violations of the Migratory Bird Treaty Act disposed of during the year, and cases still pending on June 30, 1950*

Disposition	Number	Pending	Number
Conviction	510	From preceding year	163
Dismissal	41	New cases	826
Nol-pros	20		
Closed without prosecution	23	Total	989
		Disposed of during year	594
Total	594	Pending at end of year	395

National Park Service

Newton B. Drury, *Director*

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THE SERVICE AND USEFULNESS to the American public of the National Park System has increased in gratifying measure in the fiscal year 1950. That the Congress is coming more fully to appreciate the part the System plays in American life was attested by the substantial increases in appropriations for the year. These were sufficient, for the first time since the war, to permit adequate maintenance of roads and trails and to provide somewhat more of the most urgently needed physical improvements. Road construction was also carried on at a greater rate than had been possible in any year since the war. This progress, however, was no more than a bare start in catching up with the tremendous backlog of projects for which there is present need.

One problem above all others has faced the National Park Service in its endeavor to protect and preserve the invaluable scenic, scientific, and historic resources comprised in the National Park System. It has stood out in bold relief during the past year. There is a constantly growing demand for commercial utilization of resources in the parks, especially their flowing waters. Enlightened and broad-gage conservation organizations throughout the country share the concern of the National Park Service, and have given voice to it. They realize, as we do, that the future of the national parks is at stake.

We have noted in annual reports of the past several years the increasing number of instances in which projects in the programs of the Corps of Engineers and the Bureau of Reclamation have been based upon the expectation that dams and other water-control structures would be built in national parks and monuments or that even if located outside they would be permitted, in one way or another, to destroy or impair the beauty and interest of these places—the qualities which are the very basis of the special status which has been given them.

This trend highlights the necessity for long-range national planning for balanced use of our resources of all kinds in such a way that the cultural needs of the American people, of today and tomorrow, are not relegated to a subordinate position; that our national thinking is not guided by the false concept that economic benefits must take precedence, as a matter of course, over other benefits not expressible in money terms but of vital importance to the business of living. The American way of life calls for proper proportion between the two kinds of demand made upon natural resources—those whose immediate purpose is economic and those whose immediate purpose is social and cultural. There is ample evidence that those who have worked for the establishment and protection of the National Park System, including many Congresses, have seen clearly the need of ministering to something more than bodily needs of men. There is need now for reaffirmation, plainly and unequivocally, of the concept that great natural beauty, the product of Nature's processes at work through eons of time, can and shall be preserved by this Nation as one of the things men live by, essential to fullness of life and not lightly to be destroyed.

Frequently heard are assertions that the construction of a dam and reservoir in a national park will leave it uninjured, or will improve it, scenically; that it will be "improved" for recreation; or that some other area "just as good" can be substituted for the one in which such a development is proposed. Americans long ago learned to be dubious of claims of "just as good."

Such assertions are based on a misconception of the essential character of these special areas and the purposes which they are designed to serve. The great national parks have been "set aside" to provide for human enjoyment of their natural features and their natural character. When the free flow of a stream is blocked and a valley is buried beneath impounded waters, that natural character is lost, and lost irretrievably. Leaving out of consideration the matter of the national interest—which is another question entirely—the exchange is one of a rarity for the relatively commonplace.

The National Park Service fully appreciates the value of water recreation. It is provided and encouraged in many of the areas of the National Park System. The Service works, wholeheartedly and conscientiously, with both the Bureau of Reclamation and the Corps of Engineers in exploring and appraising the recreational possibilities of the reservoirs they are constructing or planning. But it is not ready to admit—in fact, emphatically denies—that an artificial body of water is ever a satisfactory substitute for a natural scene so extraordinary or unique as to be deserving of national park or monument status. Opportunities for the kind of recreation obtainable from these reservoirs is certainly not going to be rare or hard to come at, in view of the immensity of the programs of the Corps of Engineers and the Bureau of Reclamation. Steadily, however, the greatest works of nature—and also many significant sites of history—are being deteriorated or destroyed in the zeal for commercial "progress."

The parks in wartime.—At the end of the fiscal year it was entirely too early to gage the implications of the international situation. However, the National Park Service, mindful of the great variety of uses to which the system was put during World War II, must be prepared in case of necessity to devote them to purposes which will contribute to the welfare and safety of the Nation. Their greatest value, in any time of crisis, will always be that of supplying relief from physical and mental and spiritual tensions, of strengthening men and women for difficult and demanding tasks. That value was amply demonstrated in World War II. Eight million men and women in uniform visited the parks. To supply that value to the utmost, and to protect the areas and their facilities from damage or deterioration, it is necessary that the administrative and protective organization be maintained at effective strength at all times. It is possible to economize to an extent that, in the long run, is extravagant because it is wasteful.The system was the victim of such a situation from 1941 to 1945; it should not be again.

DAMS, PARKS, AND MONUMENTS

Dinosaur National Monument Dam proposals.—The National Park Service opposed the Bureau of Reclamation proposal to construct dams at Echo Park and Split Mountain, in Dinosaur National Monument, in Utah and Colorado. In this they had the unanimous support of the conservation groups of the Nation and of many individuals. The issues involved were thoroughly explored in a public hearing called by Secretary Chapman in Washington on April 3. With the Secretary's full approval, the National Park Service notified organizations and individuals believed to be opposed to the construction of dams in national park areas, and invited them to present their arguments at the hearing. The Service itself expressed its vigorous opposition, contending that outstanding scenery as well as significant natural and prehistoric features of concern to the Nation would be destroyed; that alternative outside dam sites could be utilized, and that departure from the policy of inviolate protection of the national parks would establish a dangerous precedent.

The building of the dams was supported by the Bureau of Reclamation and by representatives of the States which would benefit from the power to be produced from the two dams and from the storage of water which they would provide.

After full consideration of the evidence, Secretary Chapman decided to recommend to Congress that it authorize the construction of the two dams. On June 27, 1950, he stated:

> I am not unmindful of the public interest in the inviolability of our national parks, and in the status, only a little less austere, of the national monuments. By no precedent of mine would I wish to endanger these places.
>
> Weighing all the evidence in thoughtful consideration, I am impelled in the interest of the greatest public good to approve the completion of the Upper Colorado River Basin Report, including the construction of the dams in question, because:

(*a*) I am convinced that the plan is the most economical of water in a desert river basin and therefore in the highest public interest; and

(*b*) The order establishing the extension of the monument in the canyons in which the dams would be placed contemplated use of the monument for a water project, and my action, therefore, will not provide a precedent dangerous to other reserved areas.

I ask the National Park Service and the Bureau of Reclamation to cooperate fully in making plans that will insure the most appropriate recreational use of the Dinosaur National Monument, under the circumstances.

Ultimate decision on the proposals rests with the Congress. The Secretary's assurance that his decision was based upon special circumstances, and his reaffirmation of long-established policy as to the integrity of national park areas, is gratifying to the National Park Service.

Other dam proposals.—Several previous reports have made reference to the Corps of Engineers proposal to construct a flood control dam at Mining City which, under certain flood conditions, would cause water to be backed up into Mammoth Cave. The omnibus rivers and harbors flood-control bill, approved in May, was amended to prohibit construction of this dam "if such construction would have any adverse effect on Mammoth Cave National Park." Conservationists generally urge rescinding the authorization for the dam.

Several pending bills would authorize development of the full power potential of the Kings River watershed by the Bureau of Reclamation as part of the Central Valley project in California, and would authorize investigation of sites within Kings Canyon National Park. However, the Department has recommended elimination of the park from the provisions of these bills. Although Cedar Grove, containing developments serving park visitors, and Tehipite would still be subject to investigation and possible development, most conservationists familiar with these two exceptional segments of the Sierra country strongly oppose their being utilized for water storage.

Last August, Representative Mansfield, of Montana, introduced H. R. 6153, which would authorize and direct the Corps of Engineers to construct the Glacier View Dam, which would flood about 20,000 acres of Glacier National Park. Previously, the Secretaries of the Interior and the Army had agreed on its elimination from the present plans for the Columbia River Basin. The bill, on which the Department reported adversely, was referred to the House Committee on Public Works, which has not acted on it.

The Department was successful in its request that S. 75 be amended to limit the height of the proposed Bridge Canyon Dam on the Colorado River to an elevation of 1,877 feet. The original bill gave this as the minimum elevation. The change was sought in order to minimize the damage to Grand Canyon National Monument and Park.

The bill has passed the Senate but the House had taken no action on it at the close of the fiscal year.

Under the terms of a 1945 treaty with Mexico providing for the division of the waters of the lower Rio Grande, the International Boundary and Water Commission has authority to build an international dam in Big Bend National Park or at a site which would back water into it. Fortunately, the Service has found the executive officer of the Commission sympathetic to its desire to protect the park, and eager to find a site which will not involve injury to it.

PLANNING AND CONSTRUCTION

Needed development advances.—The completion of roads and trails and parkway construction and physical improvements throughout the National Park System was delayed by the late passage of the 1950 Appropriation Act. For many of the areas, funds became available too late to accomplish anything during the 1949 calendar year, and the letting of contracts had to be put over until late spring. Thus, though work under such contracts is expected to be largely completed during the 1950 construction season, very little of it was finished at the end of June.

Nevertheless, the past fiscal year has seen more progress in providing needed developments than in any other year since the war. The Congress provided somewhat more liberally for these needs, labor was more readily available, and materials prices were more stable than had been the case during the preceding years.

The physical improvements program consists mainly of campgrounds; utility systems such as water, sewer, power, and communications; and employee housing. Larger projects include such work as the completion of the museum building at Ocmulgee National Monument, begun several years before World War II; the restoration of Castle Clinton, not started by the end of the year, since the national monument was not officially established until mid-July 1950; extensive redevelopment at the Statue of Liberty; construction of a long-needed water-supply line to Mesa Verde National Park; and the museum building at Custer Battlefield National Monument.

Under the roads and trails program, emphasis has been placed on surfacing or resurfacing of existing roads, and on advancing the construction of roads previously started, in some cases before the war. The parkways program consisted of the normal process of advancing construction as far as funds would permit.

In spite of the somewhat more liberal appropriation for physical improvements for 1950, it would take many years to provide the improvements that are already needed; and the need of spreading available funds as widely as possible prevents economical expenditure, since it is necessary to handle piecemeal many projects that could be constructed more cheaply if covered by a single contract. In a number of places—Glacier National Park, for example—expensive equipment must still be stored in structures which, if they burned, would destroy equipment worth considerably more than would be required to provide safe storage. Invaluable museum materials—some of them irreplaceable—are also in danger of destruction until they can be safely housed.

Regional reorganization of planning and construction groups.—The union of architecture, engineering, and landscape architecture into a single division, put into effect in the Washington office several years ago, was applied to the regional offices during the past year to establish in each a single division of planning and construction, headed by an assistant regional director. This change was made to provide close coordination of all the types of professional and technical effort which have a part in the planning, construction, and maintenance of physical facilities in the National Park System.

Housing shortage continues serious.—During the past 2 years, 30 employee residences have been completed or started. These, and the few units completed previously, may be expected slightly to alleviate the shortage. However, it is estimated that 591 units are required to provide satisfactory housing, so the amount of alleviation is slight. Of the 479 single residences required (the balance being apartments or dormitory units), slightly less than half should contain either 3 or 4 bedrooms. These cannot be built, however, under the space and funds restrictions presently imposed.

More areas hook up with commercial power.—During the past year Carlsbad Caverns, Yellowstone, Yosemite, and Olympic National Parks; Devils Tower, Dinosaur, Effigy Mounds, and El Morro National Monuments; and Theodore Roosevelt National Memorial Park have established, or undertaken negotiations for, electrical service from local electric companies and REA cooperatives. These replace the expensive, limited, and often unreliable power units previously established in these areas.

Radio communications being extended rapidly.—To reduce the heavy costs of replacing or repairing telephone lines, frequently damaged by storms and floods, and to insure more reliable communications, the installation of radio systems is being rapidly expanded. At the end of the fiscal year, the $74,000 system at Mount Rainier was about 60 percent complete, and will be finished before the end of the calendar year. So also will that at Olympic, costing $84,000. Isle Royale National Park, approximately 70 miles from Houghton on Michigan's Upper Peninsula, is being equipped with the most modern type of FM radio equipment for communicating with mainland park headquarters at Houghton and points on the island. These installations will eliminate all telephone-wire lines in the park, except those required for serving the developed areas.

Water.—Construction of the West Mancos water supply system for Mesa Verde National Park, long planned to replace the expensive and unsatisfactory deep-well supply, has at last been assured and is well started. Three contracts for materials and construction, totaling $321,579.70, were awarded. Necessary rights-of-way were obtained from the Forest Service and the Bureau of Land Management; private lands are being crossed on canal and ditch rights-of-way reserved in patents issued under the act of August 30, 1890. Conditional rights to 107,700 gallons a day were decreed in June 1943.

Statue of Liberty undergoing transformation.—Utilizing the $500,000 earmarked for the purpose in the 1949 appropriation and more than $300,000 of 1950 funds, the Service's long-planned improvement program for Statute of Liberty National Monument is now well under way. Contracts were awarded before the end of the fiscal year for work to be done during the 1950 and 1951 calendar years. A major improvement will be the substitution, for the pier now in use on the east side of the island, of a new covered pier on the west side, approximately in the same location as the old wooden pier on that side which has long been in disrepair and unused. Among other projects covered are dredging a boat-turning basin and channel near the new pier; riprap and land-fill work at the north end of the island; erection of an addition to the concessions building, on which construction was started before the war; and installation of underground utilities for the new residence area. Other work already completed includes a heating system for the statue; demolition of additional obsolete buildings; riprap and fill; planting of trees and shrubs; and the installation of lipstick-proof carrara glass informational signs.

Much work remains to be done, the most important being the completion of the protecting sea wall, to extend completely around the island.

Mississippi River Parkway survey begun.—By an act approved last August, the National Park Service and the Bureau of Public Roads were authorized to investigate and report to Congress on the feasibility of constructing a parkway following generally the course of the Mississippi River from its source to the Gulf, and as to the most desirable method of its establishment and administration. Of the $250,000 authorization, $150,000 was appropriated for the 1950 fiscal year.

The survey is being conducted under the joint direction of H. J. Spellman, division engineer of the Bureau of Public Roads, and T. C. Vint, chief of Planning and Construction for the National Park Service. Stanley W. Abbott, formerly superintendent of the Blue Ridge Parkway, is in charge of the Service's part of the work.

An advisory group, the Mississippi River Parkway Planning Commission, with 90 members appointed by the governors of the 10 Mississippi River States, has been set up. It is headed by A. P. Greensfelder of St. Louis. To keep the members of the commission, members of Congress, the press, and interested individuals informed of the progress of the survey, its staff is issuing and distributing a bulletin at intervals of a month or so. Progress during the short period since the staff was set up has been most satisfactory.

Roads and trails maintenance.—This was the first year of operation under the 5-year program of catching up on the backlog of special roads-and-trails maintenance items, deferred because of the war, before they reach such a stage of disrepair as to require reconstruction. With $3,500,000 available for roads-and-trails maintenance, it was possible to do routine work and to liquidate about 21 percent of the backlog.

The equipment amortization program, begun this year, provides more adequately than previously for the replacement of road and trail equipment which had had to be kept in service long past the point of economy. Through it, maintenance costs have been definitely reduced.

Mount Rushmore sculptures floodlighted.—The installation of floodlights for the heads of Washington, Jefferson, Lincoln, and Theodore Roosevelt at the Mount Rushmore National Memorial, for which funds were earmarked in the 1949 appropriation, was completed last November. The installation consists of 54 1,500-watt floodlights placed in two locations approximately 1,400 feet in front of and 400 feet below the images. It includes also the electrical distribution system and trail and parking-area lighting. It is expected that a few additional lights at a third location, to eliminate undesirable shadows, will be installed this summer.

Hot Springs cooling system placed in operation.—The cooling and distribution system for the thermal waters of Hot Springs National Park, for which engineering investigations and surveys were started in 1937, was completed early in 1950, and the cooled-water service was made available to the bathing concessioners last January. Initiation of the project, first postponed because of the war, was again delayed by the 1946 Presidential order postponing all Government construction projects not absolutely necessary.

The need for such a cooling plant, constructed at a cost of approximately $164,000, was recognized for many years, during which the cooling of the spring water was accomplished by its exposure to air passing through cooling towers. Contact with the air caused the loss of some of the radon emanation, considered to be a source of therapeutic value of the water. In addition, the water absorbed pollen and dust, and there was an appreciable evaporation loss.

HISTORY AND PREHISTORY

The basic laws relating to the National Park Service make the preservation of historic sites, structures, and objects and their display for the public benefit one of its major duties. The properties which the Service administers cover an extraordinarily wide range of prehistory and of the history of the Nation from the earliest periods of colonization up to relatively recent times. The past year has seen much progress in rounding out these holdings.

Establishment of Effigy Mounds National Monument, in Iowa, brought into the system an outstanding example of the mound builders' handiwork in a region not hitherto represented. The new DeSoto Memorial in Florida is a reminder of another phase of the history of Europeans in America, the precolonial exploration. The expected acquisition of St. Croix Island, Maine, authorized as a national monument, will add the significant remains of the 1604 settlement established there by De Monts and Champlain. Staffing of San Juan National Historic Site in the Puerto Rican capital has revealed a great curiosity, among both residents and visitors, about those gigantic defense works and their significance in the history of the New World.

Particularly gratifying is the fact that the first, but extremely important, steps have been taken toward establishment of Independence National Historical Park, embracing sites and structures of supreme importance in the Republic's history. Related to these, is the Deshler-Morris House, in Germantown, which is to have the status of a detached portion of the Independence National Historical Park project.

These and all the other prehistoric and historic properties of which the Service has custody demand the most exacting care; their truthful and fair interpretation to the public equally requires a continuous program of research. In a number of important instances, this involves the use of archeological techniques, which have been applied to such sites as Fort Raleigh, Jamestown and Yorktown, Hopewell Village, Saratoga, Fort Vancouver, and the Whitman Mission. At all those places archeological "digs" have produced materials and brought out facts of importance and significance. Much of the material is still to be studied, classified, and evaluated.

Real progress in historical research.—The past year was a fruitful one in the field of historical research, despite the fact that this work by field historians has to be sandwiched in among many other duties. A ground cover study at the Saratoga National Historical Park, as of the date of the 1777 battle, disclosed the true distribution of fields and woods and made known other physical features of the historic terrain. A similar historical base map was made of the Wilderness Battlefield, part of the Fredericksburg and Spottsylvania County

National Military Park. A preliminary historical study was made of the layout plan of the 1604 settlement on St. Croix Island, Maine. Test excavations there unearthed stone foundations believed to have been those of one of the principal buildings of the settlement. Historical studies by the historian at Fort Sumter National Monument disclosed the physical appearance of the fort at three critical periods of its wartime history.

At Gettysburg National Military Park, preliminary investigations were made of the origin and past history of the Gettysburg Cyclorama, the famous painting which depicts the battle at the time of Pickett's Charge. In connection with the Independence National Historical Park project, the site of Franklin Court, historically important as the site of Benjamin Franklin's residence in Philadelphia, was identified and the boundaries of the estate defined.

Western historical areas likewise received attention. A detailed, well-illustrated survey of the history and physical structure of Fort Vancouver, Wash., was prepared and mimeographed in connection with the national monument project there. Preliminary studies were made of the authenticity of the Elkhorn Ranch site and the Maltese Cross Ranch Cabin of Theodore Roosevelt. A study was also made of his participation in the Stockmen's Association as a cattle owner in the Dakotas.

Studies have been started on the history and historical source materials relating to the ancient fortifications of San Juan, P. R., of which the principal remaining works are included in the San Juan National Historic Site. A study of the ancient City of Refuge, on the island of Hawaii, proved the desirability of preserving it as a national historic site.

Three important research reports in the field of archeology were prepared. One deals with the Bynum site, on the Natchez Trace Parkway in Mississippi, which is prehistoric. This report is being printed. The other two deal with historical areas—the second season's excavations at the Whitman National Monument, in Washington, and the excavations at Fort Raleigh National Historic Site, N. C.

One of the most interesting developments of the year was the 3-month study, in Great Britain and on the Continent, of early glasshouse sites and early glass-making technology as known to experts abroad, and as exemplified in European museum collections. This assignment was carried out by Archeologist J. C. Harrington, who had excavated the glass works at Glass House Point, Jamestown; it was financed by a donation of $2,500 by Glass Crafts of America, an association of companies producing handmade glass.

Numerous historic areas dedicated.—The year has been marked by the number of dedicatory ceremonies at sites of historical significance. The authorization of establishment of St. Croix Island National Monument was celebrated at Calais, Maine, and on the island, on July 2, 1949, by speakers representing both the United States and the French Governments. Dr. Douglas S. Freeman, noted historian of the Civil War, was the speaker of the day at well-publicised exercises held on August 29, 1949, dedicating the Dogan House at Manassas National Battlefield Park, which had been purchased by the Prince William County Chamber of Commerce and presented to the Federal Government for addition to the park. On March 24, 1950, De Soto National Memorial at Bradenton, Fla., was dedicated. The dedication of the reconstructed McLean House, at Appomattox Court House National Historical Monument, in Virginia, on April 16, 1950, attracted a tremendous throng. The presence of Maj. Gen. U. S. Grant, III, and of Robert E. Lee, IV, lent particular interest to the event. Dr. Douglas S. Freeman again was the principal speaker. The State of Virginia has provided $5,000 to furnish the parlor of the McLean House where Lee and Grant met on April 9, 1865. The Virginia Federation of Women's Clubs is providing $800 for landscaping the grounds.

The statue of Cabrillo, originally presented to the State of California, was erected on the grounds of Cabrillo National Monument after a somewhat controversial and wandering history, and was dedicated with impressive ceremony on September 28, 1949.

Governor Lane of Maryland made the dedication address when Hampton National Historic Site, near Towson, Md., was dedicated on April 30, 1950. The Deshler-Morris House, in Germantown, Pa., was dedicated and formally opened to the public on May 16, with Ronald F. Lee, chief historian of the National Park Service, delivering the dedicatory address. Under cooperative agreements, Hampton is being administered by the Society for the Preservation of Maryland Antiquities, the Deshler-Morris House by the Germantown Historical Society.

Coincident with an address on foreign affairs which made international headlines, President Truman dedicated the Jefferson National Expansion Memorial project in St. Louis, on June 10, 1950, on the occasion of the reunion of the Thirty-fifth Division, of which he is a member.

Interpretation of historical areas.—Like the other areas in the National Park System, the many historical areas administered by the Service have felt the impact of a steady increase of visitors. During the last travel year these totaled 12,362,917. We have reported previously that the staggering number of visitors to such shrines as the Home of Franklin D. Roosevelt and the Lee Mansion threatened the safety of those buildings. This year it has become necessary to rely upon self-guiding devices at the Vanderbilt Mansion National Historic Site, at Hyde Park, and at other heavily visited area. Fortunately, the public has liked the printed guide sheets and other devices substituted for more personal guide service.

The new museum exhibits at Manassas National Battlefield Park have proved enormously helpful and continue to elicit much favorable comment. On July 4, 1949, the Governor of North Carolina and other distinguished guests participated in the opening of the new Guilford Courthouse Museum exhibits. Some of these were generously contributed by representatives of the English regiments which participated in the battle of March 15, 1781.

Funds are now available for construction of the museum at Custer Battlefield National Monument. The year has brought progress in planning its exhibits, as well as those in honor of John Peter Zenger's contribution to freedom of the press which are to be placed in the Federal Hall Memorial in New York City.

Chief historian at Paris conference.—The Service was honored by the selection of Ronald F. Lee, its chief historian, as a delegate from the United States on the Committee of Experts on Sites and Monuments of Art and History, assembled in Paris, France, on October 17–21, 1949, by the Director-General of UNESCO. Mr. Lee was chosen rapporteur for the meeting, which included representatives from 12 countries. The committee formulated recommendations to UNESCO regarding the character of the program which it should consider developing to further international cooperation in the preservation of historical and archaeological sites and buildings.

River Basin salvage archeology.—Contracts with State universities and State historical societies and museums to excavate important archeological sites to be inundated by multipurpose reservoirs have made possible great strides in the task of salvage. Under these contracts, the Federal Government supplies funds and equipment while the contracting agencies furnish scientific personnel, additional funds, and laboratory facilities.

Within the Missouri Basin, contracts have been entered into with the following agencies for excavation of the several reservoirs indicated: University of Nebraska Laboratory of Anthropology, Harlan County Reservoir; Nebraska State Historical Society Museum, Trenton Reservoir; Universities of Kansas and South Dakota, Fort Randall Reservoir; North Dakota State Historical Society, Garrison Reservoir; University of Wyoming, Boysen Reservoir; and University of Montana, Canyon Ferry Reservoir.

Elsewhere, the Service has entered into contracts with the University of Texas for work in the Falcon Reservoir, and with the University of New Mexico for intensive excavations in the Chamita Reservoir.

Congress authorizes national trust.—The National Trust for Historic Preservation in the United States was organized on May 1, 1950, under the chairmanship of Mr. David E. Finley, director of the National Gallery of Art, as authorized in an act of Congress approved by the President on October 26, 1949. Modeled after the National Trust of Great Britain, its purpose is to supplement, on a national scale, the work of the National Park Service in holding intact sites, buildings, or other objects significant in American history. The legislation which authorizes its establishment was sponsored by the Department of the Interior and supported by the National Council for Historic Sites and Buildings.

Other officers of the Trust include Maj. Gen. U. S. Grant, III, Vice Chairman, and Ronald F. Lee, chief historian of the National Park Service, Secretary. The Secretary of the Interior, Attorney General of the United States, and Director of the National Gallery of Art, are ex officio members of its board of trustees. Other members of the Board are Horace M. Albright, Charles S. Bird, John Nicholas Brown, Harry L. Bullis, Mrs. Francis B. Crowninshield, Herbert Hoover, Gen. George C. Marshall, George A. McAneny, H. Alexander Smith, Jr., and Robert Woods Bliss.

Independence National Historical Park moves steadily ahead.—Pursuant to the act of Congress authorizing establishment of the Independence National Historical Park, the Department has entered into a cooperative agreement with the city of Philadelphia under which the National Park Service will take over custody of the Independence Hall structures and grounds in Independence Square, Philadelphia, beginning January 1, 1951. Covered by the agreement are Independence Hall, Congress Hall, Old City Hall, and associated historic objects connected with the adoption of the Declaration of Independence by the Continental Congress, the meeting place of that Congress, the seat of the Government of the United States during the Revolution and the period 1790–1800, and the meeting place of the Constitutional Convention of 1787.

The buildings in Independence Square contain a priceless collection of historic paintings and historic objects, including the Liberty Bell. They attract about a million visitors each year. By the terms of a special cooperative agreement with the Carpenters Company of Philadelphia, historic Carpenters Hall will also be exhibited by the National Park Service as a part of the Independence National Historical Park program.

For the 1950 fiscal year, Congress appropriated $500,000 to enable the National Park Service to begin its acquisition program, and it provided contract authorization in the amount of $3,935,000. A project office was established in Philadelphia by the Service at that time.

Appraisal of historical areas.—Preliminary to the formulation of recommendations by the Advisory Board on National Parks, Historic Sites, Buildings, and Monuments on proposed additions of historical properties to the System, it is almost invariably necessary to undertake a certain amount of research in order that the Board may evaluate them properly. That this is a sizable task is indicated by the fact that the Service conducted such research in connection with 78 proposals for additions to existing historical areas or for new areas. Forty-three of these were covered by bills introduced into the House or Senate and reports on all of them were prepared for submission to Congress.

These constitute only a part of the research which Service historians and archeologists must carry on in order that the interpretive program may be brought to its highest effectiveness and the full usefulness of our historical and archeological possessions may be realized. During the 14 months from January 1, 1949, to May 1, 1950, the historical staff prepared 40 research reports. It also produced 12 historical studies relating to surplus forts and military posts to assist in their proper disposition as State historical parks and monuments, and 3 reports on reservoir areas to encourage the preservation of historical values in areas to be flooded. On their own time, the members of this same group produced 14 articles and 3 pamphlets on historical subjects.

Archeologists of the Service prepared 22 archeological reports, of which 11 were printed in professional journals, as were 5 other reports produced in off-duty hours. In addition, 34 archeological reports dealing with river basins were prepared in collaboration with the Smithsonian Institution and in association with colleges and universities cooperating with the Service and the Smithsonian in river-basin archeological salvage.

NATURAL HISTORY

Interpretive activities.—The public's appetite for greater knowledge and understanding of the natural phenomena of the national parks shows no sign of decrease. The satisfaction of this desire is certainly one of the most constructive functions of the National Park Service, but the performance of the task continues to lag seriously behind need. Though there was a slight increase in employment of seasonal rangers and ranger-naturalists, the percentage of increase in number of visitors utilizing their services considerably outran it. The handicap of increased numbers—or rather of insufficiencies of staff to care adequately for them—is such that much of the effectiveness of the work is lost.

Much thought has been given to methods of dispensing information at entrance stations, particularly in the larger parks and those in which the visitor volume has increased at a much greater than average rate. To expedite the handling of visitors, it has been necessary to install cash registers or accounting machines in some parks, and there is no satisfactory opportunity to give out needed information or to enlist cooperation in the protection of the natural features. Real contact with the visitor is highly important.

Parking areas inside the gates, attractive information offices, and, above all, enough competent personnel to man them have been suggested and in some cases have been approved, but their installation must await the availability of funds.

Statistically speaking.—The records of the past year show that the Service's naturalists have conducted 24,076 guided trips, with 1,144,250 persons participating. They have given 25,987 talks, principally at evening campfire programs, to an attendance of 2,442,834. Other informational contacts by this group brought the total to 4,333,963 persons. Visitors have also been reported at unattended interpretive stations and devices and in museums to the number of 6,741,196.

In the museum field.—The year has brought very tangible progress in the Service's museum activities. Three new museums were opened, and work is in progress on the preparation of exhibits for three more. The opening ceremonies at Guilford Courthouse National Military Park have been mentioned elsewhere. Hampton, near Baltimore, completely repaired through the generous provision of funds by the Avalon Foundation, is a house museum. The reconstructed McLean House at Appomattox Court House National Historical Monument was also placed on exhibition with appropriate furniture. At Scotts Bluff National Monument, water colors, sketches, and photographs by the late William H. Jackson were installed in the new Jackson wing to illustrate the Oregon Trail story.

Complete interpretive displays telling the story of the Battle of Chickamauga were in preparation for the headquarters museum on the battlefield. Helped by funds donated by the Hui-O-Pele Society, work was begun on a museum for Hawaii National Park. The Museum Laboratory completed and shipped the first two of seven major exhibits, and work on others was underway. Additional exhibits are being prepared in Hawaii. Work has been started on exhibits for Ocmulgee National Monument, where a contract has been let for completion of the museum building, begun before the war. A contract has also been let for erection of a modern museum and administration building at Custer Battlefield National Monument.

For the second year an in-service training course in museum methods, with a class of 10, was conducted at the laboratory as a combined operation of the Natural History and History Divisions in order to develop a body of field employees familiar with the everyday policies and techniques required to maintain and use their museums skillfully.

As custodian of many objects of scientific or historical value, the National Park Service has the responsibility of protecting them from all kinds of damage and deterioration caused by such common agents as fire, sunlight, mold, insects, and rodents—a major problem. Reports of surveys undertaken during the year demonstrated the need so clearly that a continuing program of inspection and treatment by experts has been set up to begin during the 1951 fiscal year.

Natural history associations.—Organization of the Olympic Natural History Association during the past year brought the number of these designated cooperating organizations throughout the Service to 21. Additional associations are being organized at Joshua Tree National Monument and Acadia National Park. Because of their official cooperative status these organizations are required to submit annual reports to the Director of the National Park Service, which are analyzed carefully by the Natural History Division.

The associations carry on a variety of money-making activities. One of the most important is the production and sale of literature of various kinds. Earnings are used to advance the interpretive programs in the areas in which they function. Gifts of equipment needed in the conduct of these programs are among the most tangible evidences of their assistance. Motion picture and slide projectors, record players, sound recorders, cameras, lenses, range finders, and many other items of tools, equipment, and supplies are listed among their contributions during the past year. Approximately $2,000 of association funds were spent to purchase books, magazines, pamphlets, and supplies for park libraries. The Glacier Natural History Association expended more than $1,000 for the purchase of private lands and a mining claim. These organizations perform an invaluable service to the interpretive program.

Wildlife overpopulations.—Though an important principle of national park management is to present wildlife "natural" and with the minimum of manipulation, control measures are necessary occasionally, especially when natural controls or outside hunting fail to hold populations to safe carrying capacity of the range. Elk, mule deer, and moose present problems of this kind in a number of areas.

One of the most serious is that of the northern Yellowstone elk herd. Weather conditions last winter prevented the needed reduction from 11,000 animals to 6,000. The actual reduction totaled less than 1,000—507 killed in the park, 316 live-trapped and shipped elsewhere, and probably not as many as 50 killed by hunters outside of the park. Drastic action will be required next winter to avert almost total destruction of winter browse in the park. At Rocky Mountain, egal hunting outside and official killing within produced a needed eduction of 500 elk. Hunting and natural causes have brought the lk of Glacier National Park down about one-third.

Bison reductions were carried out both in Yellowstone and in Colorado National Monument. Enlargement of the range, by throwng the bison on lands formerly in the Custer Recreational Demonstration Area, provided relief for the 400 head at Wind Cave.

The mule deer is a problem species in several areas. Last winter he Service destroyed 100 at Rocky Mountain because of the critical state of the food supply. California parks generally are overpopulated.

Rare species.—The past decade has seen an improvement in health and numbers of bighorn at Glacier, while Dall sheep in Mount McKiney are increasing about 20 percent annually Elsewhere, bighorns are not thriving. The population is stationary at Rocky Mountain, declining in Yellowstone, and apparently extinct in Zion and in Dinosaur National Monument.

Trumpeter swans in Yellowstone had a highly successful nesting season in 1949, the August census revealing 54 adults and 21 cygnets. Results this year will probably be somewhat less favorable.

Fishes and fishing.—Though there is a tremendous amount of fishing throughout the National Park System, manpower has been generally inadequate to gather even the most elementary information on fishery resources and the drain due to angling. Many areas greatly need personnel to guide fishery and other wildlife programs.

Enlargement of Everglades National Park to include Florida Bay has paved the way to better protection of important fish resources, depleted by commercial overfishing to the detriment of fish-eating birds of exceptional interest. Anglers are finding better sport at Shenandoah under the new policy which prohibits stocking legal-size fish. Fishing pressure at Yellowstone has made necessary a catch-limit reduction to five a day. Total protection is given to grayling because of the alarming decrease in that species.

Axis deer for island of Hawaii opposed.—The proposal of the Territorial Board of Agriculture and Forestry to introduce axis deer on the island of Hawaii for the benefit of sportsmen created considerable apprehension in view of the experience there with other feral animals. So unanimous was the public protest that the Board reconsidered its decision and voted to defer action on the project.

PARK ACCOMMODATIONS

Secretary Chapman approves revision of concession policies.—The need of improvement and expansion of overnight accommodations and appurtenant facilities in many areas became evident immediately after wartime controls on travel were removed in 1945, and has become greater each year. Former Secretary Krug late in 1948 enunciated new concessions policies. It was hoped that with a definite statement of policy by the Secretary it would be possible to induce park concessioners to add to their facilities. However, funds for substantial capital investments proved unobtainable; concessioners insisted that the Secretary's policy did not furnish either the security or the incentive necessary to encourage risk capital. This position was emphasized in hearings held by the House Committee on Public Lands.

On assuming office, Secretary Chapman undertook a restudy of the whole concession situation. A first result was his revision of the regulations governing labor conditions for concessioners' employees, to place park concessioners on a par with their competitors outside the parks. He established a standard workweek of 48 hours, with time and a half for overtime, for all concessioners except those in States which require more favorable hours and wages for hotel employees.

The Secretary called for the recommendations of the National Park Service, on the basis of its experience in serving the public through concessions contracts, and approved the following principles governing concessions:

(*a*) Rates shall be approved primarily on the basis of charges for comparable services and in accordance with general custom for similar outside operations, with due regard to a reasonable profit, taking into account the difficulty and risk of the enterprise.

(*b*) A preferential opportunity will be granted existing concessioners to negotiate a new contract if they have rendered satisfactory service during the life of their expiring contracts.

(*c*) It will be the Department's policy to cancel existing contracts prior to their expiration and grant new contracts to the same parties for an additional term (such additional term not to exceed the statutory term of 20 years) in order to attract investments in needed facilities.

(*d*) An option to purchase the concessioner's facilities may be exercised by the Secretary only at the end of the contract period or other termination of the contract; funds shall be available to the Department 12 months prior to the exercise of the option by the Government, and when the option has been exercised a valid contract between the parties shall exist.

(*e*) The present provisions of the form contract relating to the purchase of the facilities of an existing concessioner by a successor concessioner shall be continued in the form contract.

(*f*) The Government recognizes the concessioners' right of possession in structures and facilities erected by them, and appropriate provisions relating to this subject shall be incorporated in the form contract.

(*g*) Except as otherwise provided by law, the National Park Service may procure new concessioners without the requirement of public advertising, in accordance with the provisions of existing law. A similar procedure may be followed also in the event it becomes necessary to replace an existing unsatisfactory concessioner.

(*h*) The requirement that the concessioner set aside 10 percent of the gross receipts from the rental of overnight facilities to be used to maintain and repair such facilities is eliminated, as well as the supplemental depreciation reserve provision.

Regarding the moot subject of franchise fees, Secretary Chapman stated:

> As a general policy, it is my desire that franchise fees should be related to gross revenues rather than net profits. Accordingly, I would prefer some franchise-fee provision which would make a flat fee charge in the nature of a reasonable amount for ground rent, with the requirement that the concessioner would pay an additional franchise fee for the privilege of doing business in the parks, and for services and facilities furnished, based on gross revenues in excess of a stipulated amount, such stipulated amount to be the estimated "break-even" point. In some cases, however, it may be necessary for a franchise fee to be charged on some other basis, such as net profit. In such cases, the franchise fee and other related provisions to be incorporated in the contract will be for determination on the merits of the particular case and in the light of the circumstances then prevailing. Moreover, where advisable, a provision should be included in concession contracts, regardless of the type of franchise fee charged, which will permit either party to the contract to reopen the subject of franchise fees each 5 years for renegotiation.

We are encouraged to believe that under these policies the concessioners will feel that they are being given a fair chance to make a satisfactory return on their investment, and that the hazards of their business are definitely understood. We believe it possible now, in most cases, to negotiate new contracts with a promise of improvements and expansion where plainly justified by public demand.

Pending restudy of the concession policy and the decision of Secretary Chapman on the revisions recommended by the Service, all but two concession contracts expiring during the year were extended to December 31, 1950, with the expectation that new contracts will be entered into at that time. By then, contracts will be required for 17 concessioners.

New concessions established.—Five new concessions have been established during the past year.

At Coulee Dam National Recreational Area, the Grand Coulee Navigation Co., composed of citizens of the locality, entered into a 20-year contract to furnish recreational facilities on Franklin D. Roosevelt Lake. As soon as the Government is able to install the necessary roads and utilities, this concessioner will establish facilities at the Old For Spokane and Kettle Falls areas.

The other new concessions cover an interesting variety of services One provides for photographic service at Big Bend National Park, t include lecturing and field trips on photography. Another cover transporation from the mainland to Anacapa and other islands o Channel Islands National Monument, Calif., and boat rental, refreshments, and meals and lodging on a barge at Anacapa. Northern Consolidated Airlines, Inc., was given a contract to establish camps, lodges and incidental facilities at two bases in Katmai National Monument and to provide air and water transportation services. A new temporary refreshment concession was authorized on the South Rim a Black Canyon of the Gunnison National Monument.

Rehabilitation and extension of facilities.—There has been stead progress in the rehabilitation of concessioners' plants. While th principal accent has been on sanitation and safety, much has been don to provide improved accommodations. This has included such betterments as replacement of wood stoves with gas stoves, adding new mattresses and springs, and adding running water and, in some cases baths.

The automatic sprinkler system and much of the rehabilitation a Lake Hotel in Yellowstone have been completed. The entire hote including kitchen and dining room, is expected to be ready for occupancy at the beginning of the 1951 season. An automatic sprinkle system is also being installed in the hotel at Oregon Caves Nationa Monument.

To provide expanded overnight accommodations in Yellowstone a early as possible, it has been decided to delay development at Wes Thumb and instead to build additional cabins at Fishing Bridg Tourist Camp and Lake Lodge and cottages at Lake Hotel. At th present level of appropriations, it would take 2 or 3 years for th National Park Service to provide utility systems and construct road paths, and parking areas at West Thumb. The concessioner woul also have to build costly central lodge buildings before any cabin could be used. For the same expenditure, a greater number of lodgin units can be provided earlier at existing camps, lodges, and hotels. O the 266 additional cabin rooms which the Yellowstone Park Co. ha programed for the next 2 years, the major portion is scheduled fo completion before the 1951 tourist season.

In Yosemite National Park, a new multiple-room unit to provid lodging for 84 persons is nearing completion as a part of the ne Yosemite Lodge development. Other units are expected to follo as the Yosemite Park & Curry Co. is able to finance them.

The Virginia Sky-Line Co. expects to have the new kitchen and dining room at Skyland, in Shenandoah National Park, ready for oper ion by the beginning of the 1951 season. The Service has completed he road and parking area for it and is well advanced in providing utility connections.

On the Blue Ridge Parkway, at Doughton Park, N. C., new 24-unit lodging structures were completed and in use last summer. Rough-It housekeeping cabins to accommodate about 32 persons were completed near Rocky Knob, in Virginia.

In Everglades National Park, on Coot Bay, the Service has installed temporary facilities for meals, refreshments, toilets, gasoline service, and boat rentals, which are to be operated by National Park Concessions, Inc. Permanent accommodations will not be provided until the land-acquisition program is further advanced.

New employee dormitory structures have been completed by Degnan's, the store concessioner, in the New Village at Yosemite National Park, and by the Sequoia and Kings Canyon National Park Co. at Camp Kaweah.

Ski facilities were installed by the Service on a temporary basis at Cayuse Pass, Mount Rainier National Park, last fall in the hope that a solution might be found for the problem of winter use of this park. Snowfall was exceptionally heavy last winter, complicating the problem of access, and the venture was not considered successful. Meanwhile, because winter operation of overnight facilities in the park has so consistently entailed serious losses for the Rainier National Park Co., it has been authorized to close down all its facilities during the coming winter.

The demand for overnight facilities in this park is great, and a considerable part of the present plant has long outlived its usefulness. The problem of replacement must be faced soon.

Plans for development at Hurricane Ridge, in Olympic National Park, include a lodge and a ranger station, both to be constructed by the Service. The lodge is designed in two units. One of these is to be for general public use; the other will be for overnight accommodations. Invitations to bid on the construction of the public service unit of the lodge had been advertised before the end of the fiscal year; no bids were received, however. The first section of the Hurricane Ridge Road is now under construction.

Isle Royale presents puzzling problem.—Isle Royale continues to present the problem of how to obtain satisfactory transportation from the mainland without increased accommodations in the park, and how to finance additional accommodations without reliable and safe transportation. Formerly, many visitors reached the island by one of the large lake excursion steamers or were brought in from Port Arthur, Ontario, by a Canadian boat. Neither service is available this year. Visitors are compelled to depend on two small boats, so small that many consider them unsafe, operating out of Copper Harbor, Mich., and Grand Marais, Minn.

Concession audits.—With the establishment of the new Audit Division and the employment of 25 temporary auditors, the past year has, for the first time, brought a decrease in the backlog of unaudited annual reports of concessioners. Beginning January 1, 1950, with 665 annual reports on hand for audit, 265 were audited before June 30. Meantime, 170 additional reports were received. Because the staff will have to be greatly reduced during the 1951 fiscal year, it will probably be unable to continue this gain on the heavy backlog of 570 unaudited reports on hand at the end of the year.

THE LAND PROGRAM

At the beginning of the fiscal year, the in-holdings in the national park system, excluding Everglades National Park, were estimated at 600,000 acres. During the year, by various means, this total was reduced by 64,903 acres. However, there is no possibility that this rate of progress can be maintained, since it cannot be expected that the large donations and extensive exchanges of the past year will be duplicated in the future.

Donations.—Land donations during the year aggregated 34,718 acres. The largest of these, of course, was that of lands in Jackson Hole National Monument and Grand Teton National Park, given by Jackson Hole Preserve, Inc., a corporation financed by John D. Rockefeller, Jr. Reference is made elsewhere to this magnificent gift. Mr. Rockefeller and others also donated 235.94 acres of land in Acadia National Park.

Other gifts included the Gen. Philip Schuyler Mansion, donated by George S. Lowber and others, for addition to Saratoga National Historical Park; 24.18 acres for the DeSoto National Memorial; and 1,000 acres, given by the State of Iowa for establishment of Effigy Mounds National Monument. The State of Virginia contributed $17,000 toward the purchase of the Stone House property at Manassas National Battlefield Park. The State of Louisiana purchased and presented to the Federal Government 36.36 acres of land, an important portion of the Battlefield of New Orleans, for addition to Chalmette National Historical Park.

Purchases.—The purchase of 1,907 acres of land in eight national parks and monuments was completed at a cost of $196,000. Included was a section of land in Glacier National Park, purchased from the State of Montana. At the time agreement was reached on the purchase price of this parcel, a tentative agreement on a program for acquisition of the remaining State holdings, including some of the finest yellow pine timber in the park, was reached with the State Board of Land

Commissioners. The Service is greatly encouraged by the cooperative attitude of Governor Bonner and the board in the effort to reach a solution of this situation.

Transfers.—Additions of lands, by transfer from other Federal agencies, totaled 45,080 acres. The outstanding transfer was that of 14,170 acres from the Tennessee Valley Authority for addition to Great Smoky Mountains National Park.

Everglades National Park.—On February 22, 1950, Secretary Chapman enlarged Everglades National Park from approximately 460,000 acres to 1,228,500 acres, including waters and submerged lands. Approximately 128,000 acres of privately owned land within the enlarged park are still to be acquired with the balance remaining from the $2,000,000 donated by the State of Florida for the purpose. Approximately $600,000 has been expended for 231,000 acres.

Last October Congress authorized the use of donated funds in condemnation of lands for the park, and a condemnation proceeding has been filed to obtain the remaining lands. However, numerous small parcels are being acquired through negotiation.

Two estates deeded to Blue Ridge Parkway.—Some 7,642 acres, in two estates in North Carolina, were proffered to the United States during the past year for addition to the Blue Ridge Parkway. These were the Moses H. Cone Memorial Park, in Watauga County, 3,500 acres, being donated by the Moses H. Cone Memorial Hospital, Greensboro, N. C., and the Julian H. Price Memorial Park, near Blowing Rock, 4,132 acres, being given by the Jefferson Standard Life Insurance Co. Both are to be formally designated as soon as the Attorney General approves title to the lands. These estates will add greatly to the recreational usefulness of the parkway, which traverses them.

Exchanges.—Thanks to splendid Bureau of Land Management and landowner cooperation, exchanges for unreserved public domain under the Taylor Grazing Act reduced inholdings in four western national monuments by 28,253 acres. Other exchanges, involving many thousands of acres, are being negotiated.

Abolishment of areas.—The former Father Millet Cross National Monument has been conveyed to the State of New York to become a part of the Fort Niagara State Park, as provided by an act of Congress approved September 7, 1949.

The Department of the Interior has recommended, and the Department of Agriculture and the Congressional Representatives from the districts concerned have concurred in, the proposal to abolish Wheeler and Holy Cross National Monuments, in Colorado. Both are considered lacking in the significance that would justify retaining them in the National Park System. Legislation authorizing their abolishment and transfer of the lands back to the Forest Service was pending at the end of the year.

Progress on authorized projects.—Two new areas were added to the national park system during the year. These were the De Soto National Memorial, Fla., on August 5, 1949, and the Effigy Mounds National Monument, Iowa, on October 25, 1949. At the end of the year, establishment of Castle Clinton National Monument, in New York City, awaited only the formal approval of title from the city by the Attorney General.

With the revival of interest in the Cape Hatteras National Seashore project, Governor Kerr Scott of North Carolina reactivated the Cape Hatteras Seashore Commission last January, under the chairmanship of George Ross, director of the North Carolina Department of Conservation and Development. Governor Patteson of West Virginia also announced that he planned to appoint a committee to arrange for acquisition of the West Virginia lands to be included in the authorized Harpers Ferry National Monument.

Negotiations with the Department of the Army for the additional lands needed for establishment of Fort Vancouver National Monument, in Washington, appear to be reaching a mutually satisfactory conclusion.

Moccasin Bend.—Lands lying within the Moccasin Bend of the Tennessee River, important terrain in the Civil War campaign around Chattanooga, will be added to Chickamauga and Chattanooga National Military Park, if plans involving participation in the purchase by the State of Tennessee, Hamilton County, the city of Chattanooga, and private donors are successful. City and county would each contribute $50,000, the State $100,000, and private donors the balance of the approximate $250,000 cost. Congressional approval of addition of the lands to the park will be required.

PROTECTION OF FORESTS

Fire prevention and control.—Last year's fire record was characterized by abnormally severe lightning occurrence, a comparatively large total area burned, and the largest total cost of fire suppression. However, the forest area burned over was much below average as was the total number of man-caused fires. There were 399 fires which started inside or entered areas of the National Park System during the year: 89 percent were held to less than 10 acres. Lightning caused 177 fires. The area burned over consisted of 3,530 acres of forest, 4,054 acres of brush, and 20,497 acres of grass.

Eight fires covered more than 300 acres each. The largest was a 17,000-acre incendiary grass fire in Lava Beds National Monument. Another grass and brush fire, entering the same area from the outside, burned over 2,800 acres. Everglades National Park, which is pioneering protection from fire in that portion of southern Florida and still inadequately staffed, had three relatively large fires. Lightning fires in remote sections of Sequoia and Yellowstone National Parks and a large smoker fire in the latter park were responsible for most of the high costs of suppression. The Yellowstone fires occurred when all protection agencies in the Northern Rockies were busy controlling numerous blazes.

The fire records of the Service for the past two decades were critically analyzed in an attempt to discover means for reducing the number, size, and cost, or otherwise to improve future action on fires. The analysis clearly indicated some of the major weaknesses to be the thinness with which staffs are spread for protection of large, rugged and inaccessible areas; the great diversity of activities and responsibilities, in addition to fire control, which must be carried by key personnel; the unsatisfactory communications; the inaccuracy of many existing area maps; and insufficient use of aerial detection and attack on fires in remote areas.

Protection from insect epidemics.—The serious epidemic of the mountain pine bettle which, for several years, has taken a heavy toll of the lodgepole pine forests of the Teton and Targhee National Forests, Grand Teton National Park, and Jackson Hole National Monument continues to threaten the forests of those areas and the 1,350,000 acres of lodgepole in Yellowstone National Park. Intensive control efforts have been continued cooperatively by the Bureau of Entomology and Plant Quarantine, Forest Service, and National Park Service, but the delay in providing appropriations in 1949 prevented completing the contemplated program. Some additional work was possible during the fall of 1949, and the program is being intensively carried on this year. Additional work will be needed during the 1951 fiscal year to bring this infestation under control.

Adjacent to Rocky Mountain National Park forest insects are causing serious damage. The spruce bark beetle which has ravaged much western Colorado forest is an imminent threat to the fine spruce forests of the park. On the east side of the continental divide the Douglas-fir in and adjoining the park is heavily infested by the Douglas-fir bark beetle.

The pine bark-beetle infestation in Great Smoky Mountains National Park has apparently been effectively controlled. In other parks and monuments the customary maintenance control work has been effective in keeping incipient infestations from developing into serious epidemics.

White pine blister rust control.—Satisfactory progress was made during the 1950 fiscal year by park organizations, with excellent cooperation from the Bureau of Entomology and Plant Quarantine, on control work to protect white pine forests from blister rust in 11

National Park System areas. Through the use of chemicals and hand eradication a total of 3,105,400 ribes were destroyed on 19,504 acres.

Approximately 47 percent of those portions of the 13 areas in which control is being accomplished is now on a maintenance basis. Initial eradication of ribes has been completed in Lassen Volcanic, Acadia, Glacier, Great Smoky Mountains, and Mount Rainier National Parks and on the Blue Ridge Parkway.

A very comprehensive reappraisal of blister-rust-control projects in the California parks was made by personnel of the Pacific coast regional office of the Bureau of Entomology and Plant Quarantine in cooperation with park foresters. Resulting from this appraisal, 58,700 acres were deleted from the control area in Sequoia National Park, and 39,093 acres from that in Yosemite National Park, because the expected cost of attaining control was higher than the values would justify.

Forest clean-up and rehabilitation at Acadia National Park.—Rehabilitation and clean-up of burned-over areas caused by the disastrous forest fire that swept over portions of Acadia National Park in 1947 continued during the 1950 fiscal year. Since the initiation of the project early in 1948, approximately 7½ million board feet of fire-killed timber and 275 cords of pulpwood have been removed from 2,730 acres of park lands. In addition, approximately 2,100 acres have received burned-areas treatment and 50 miles of trails have been cleared of fire-killed debris.

Originally it was thought that considerable forest planting would be required in order to restore vegetation to the burned-over areas. However, nature is providing a vegetative cover, and generally the burned areas are restocking to the same species as were destroyed by the fire.

JACKSON HOLE AND GRAND TETON

An example of extraordinary public service, and an aid to settling the long controversy over Jackson Hole National Monument, was the gift by John D. Rockefeller, Jr., to the people of the United States on December 16, 1949, of 33,562 acres of land in Grand Teton Nationa Park and Jackson Hole National Monumuent. The presentation was made by Laurance S. Rockefeller, president of Jackson Hole Preserve, Inc., and was accepted in a brief but impressive ceremony by Secretary Chapman.

The lands transferred were acquired by Mr. Rockefeller over a period of a quarter of a century with the intention of ultimately placing them under the National Park Service so that they might be protected and made available for public use and enjoyment. This generous undertaking, representing an investment of more than $2,000,000, is but one of many related to the national parks for which the American people have reason to be grateful to Mr. Rockefeller.

Senator O'Mahoney, of Wyoming, chairman of the Committee on Interior and Insular Affairs, having expressed to the President his warm approval of the gift of the Jackson Hole Preserve lands, immediately set about the task of resolving the remaining obstacles to settlement of the Jackson Hole controversy. His interest, and that of Senator Hunt and Representative Barrett, is specifically represented in a bill, S. 3409, of which the major provisions are:

(*a*) Enlargement of Grand Teton National Park to include all but approximately 9,000 acres of the Jackson Hole National Monument.

(*b*) Transfer of 6,376 acres of land now in the monument to the adjoining National Elk Refuge, and 2,806 acres to Teton National Forest.

(*c*) Confirmation of existing privileges with respect to rights-of-way and stock driveways and of the status quo of existing leases, permits, and licenses.

(*d*) Full reimbursement to Teton County for loss of taxes occasioned by transfer of privately owned lands to the Federal Government for a period of 5 years after such transfer, with progressive decreases of 5 percent from the original amount for 20 years thereafter.

Of the last of its provisions, covered by section 6 of the bill, Secretary Chapman, in his report to Senator O'Mahoney as chairman of the Senate Committee on Interior and Insular Affairs, stated that that section

> represents what may prove to be the best solution that can be reached concerning the necessary control of the Jackson Hole elk herd. This section provides, in effect, for joint Federal and State agreement as to the necessity for controlled reduction of elk within the park area. It also provides for the deputizing as Federal rangers of such hunters as may be necessary to reduce the number of elk within the area. I wish to emphasize that not only is any form of hunting contrary to the basic national park concept, as well as the statutes enacted by the Congress for administration of the National Park System, but that this Department would much prefer to have an elk herd controlled by some other method if a feasible solution could be found.
>
> There is another point regarding section 6 * * * which might give people some concern. The way the bill now reads would indicate that it is the intent that the entire Jackson Hole elk herd would be under the joint jurisdiction of the Wyoming Game and Fish Commission and the National Park Service. I know that is not the intent and, therefore, feel that some change should be made in order to clarify this point.

COOPERATIVE ACTIVITIES

Cooperation with the States.—Nearly half of the States were given requested assistance by the Service during the year. In five States Service representatives participated in in-service training institutes for their State park personnel. Review of master and lay-out plans, site surveys, help in preparation of park manuals, and preparation of a prospectus for a capital improvement program are some of the other types of assistance rendered.

Working under a joint agreement between the Department and the Governor of North Dakota, the Service is cooperating with that State in completing the International Peace Garden State Park for which Congress appropriated $25,000 of a total authorization of $100,000.

Real property disposal.—The National Park Service has continued its cooperation with the General Services Administration and other agencies by investigating applications for surplus properties desired by State and local governments for park, recreational area, and historic monument purposes and formulating recommendations as to disposal, in accordance with the requirements of Public Law 616 Eightieth Congress. Action was completed on applications for 3 separate properties, purchased by the United States for more than $7,000,000. Angel Island (Fort McDowell) in San Francisco Bay valued at approximately $750,000, was one of the larger propertie requested by local authorities for multi-purpose use. Florida ha requested the transfer of the St. Joseph's Bay Military Reservation o approximately 3,600 acres.

Reservoir development and management program.—The joint program of the Bureau of Reclamation and the Service for the development and management of reservoir recreational resources was implemented by the 1950 Interior Appropriation Act. This authorized th transfer of a maximum of $25,000 per reservoir from the Bureau to th Service for the preparation of recreational development plans, an provided $162,150 for development at Medicine Creek and Ender Reservoirs in Nebraska and Angostura Reservoir in South Dakota.

Using detailed plans prepared by the Service, the Bureau proceede with developments at the two Nebraska reservoirs and is negotiatin with the United States Forest Service on details of the Angostur development program. An agreement, now awaiting the Secretary approval, was worked out with the State of Nebraska for the manag- ment of all reservoir areas in that State.

Alaska recreational resources survey.—Field reconnaissance, launching an investigation of Alaska's scenic, scientific, historical, and recre- tional resources, was begun by the Service in May in order to develop a long-range plan for parks and recreation and to augment the development of the Territory's tourist facilities. An appropriation of $10,0 was available for the work. It is expected that additional funds w be appropriated for 1951. Several years will be required to comple the survey.

River basin studies.—Cooperation was maintained with the Bureau f Reclamation and the Corps of Engineers in appraising recreational alues and planning recreational use of their reservoirs. Investi- ation and appraisal of paleontological and archeological materials by he Smithsonian Institution under an interbureau agreement is a part f this program.

In 5 years, 379 sites have been investigated and reported on; however, asin-wide surveys, directed toward proper provision for recreation s an important element in river-basin planning, are vitally needed. start in this direction has been made in the Rogue River Basin in regon. The Service's report on the recreational aspects of this Basin, ith recommendations for protecting scenic and other recreational alues, was submitted to the Pacific Northwest Field Committee in ovember 1949. Its report, A Survey of the Recreational Resources f the Colorado River Basin, based on studies begun in 1941, has been ublished.

PUBLICATIONS

Public demand for the informational publications of the National ark Service has increased in proportion to the increase in visitors; nd the issuance of such material must of necessity have first priority n such funds as are available for printing. During the past year, quisitions were issued for 6,239,000 pieces of this literature, which distributed without charge to visitors and to others who request it.

The year also saw the issuance of the first three of a new series of storical handbooks, dealing with Custer Battlefield National Monu- ent, The Lincoln Museum and The House Where Lincoln Died, and amestown. This series, replacing the former series of 16-page rochures dealing with historic and prehistoric areas, makes use of ell-designed covers in color and of ample illustration.

Other new sales publications include Franklin D. Roosevelt at Hyde ark, by Mrs. Eleanor Roosevelt; Dinosaur National Monument, Past nd Present, by William Lee Stokes, of the Geological Survey and he University of Utah; and Artillery Through the Ages, by Albert Manucy. The last of these, illustrated by the author, has attained onsiderable popularity among military men. The Recreational Areas the United States, a map produced during the 1949 fiscal year by he former United States Travel Division of the National Park Serv- e, was also placed on sale through the Superintendent of Documents.

Natural history associations and similar cooperating organizations ontinued to supplement the Service's program with a variety of pub- cations dealing with natural history, history and archeology. Dur- g the calendar year 1949, some 15 items were produced; 8 of these ere new; 7 were reprints or revisions of previously issued items.

PERSONNEL

Park ranger examination.—Important both as to numbers affected and the improvement of morale, was the park ranger examination held on a Nation-wide basis last August. The first such examination given since 1937, it produced an eligible register of 325 names. Included were 104 of the 128 incumbents of permanent park ranger positions who had been appointed during and after the war with the proviso that they would be separated if they did not establish sufficiently high grades in the first appropriate postwar examination. All incumbents who were on the register have now been given permanent appointments. The removal of uncertainty as to tenure undoubtedly held in the career service many promising young men who might otherwise have left it.

In-service training.—The first series of in-service training courses since the war, aimed specifically at identifying and developing selected employees for more responsible administrative posts, was completed during the year. One course has been given in each region, the last having been in the Region 4 Office, San Francisco, last March.

Approximately 25 employees below grade 9 are carefully selected in each region for these courses. Assembled in the regional office, this group receives 10 days of intensive instruction in all phases of Service policy and administration. Instructors have included the Director, the Department's Director of Personnel, representatives of the FBI and the Bureau of the Budget, and other administrative and technical experts within the Service. The process has been most successful in identifying and evaluating administrative talent.

SAFETY

Administering many areas which, because of their rugged terrain or their thermal features, invite accidents to the careless or the unwary, the National Park Service is acutely conscious of its responsibility to promote safe public use and to devise and install facilities, within reason, calculated to reduce the chances of injury or death. In addition, its field personnel are continuously schooled both in accident prevention and in rescue work. In the latter connection, it is worth noting that there were no fatalities among Service personnel during the year, in spite of the fact that they were called on to perform a number of hazardous rescues.

During the calendar year 1949, there were 44 fatalities among visitors. The causes, and the number of fatalities from each, were as follows:

Motor vehicles, 18; drowning, 13; falls (mountain climbing), 7; electrocution, 1; skiing, 1; scalding (thermal areas), 2; and unknown,

2. The number of visitor-accident fatalities during the first 6 months of 1950 totaled 11, compared with 17 during the same period of 1949.

The first use of a helicopter for rescue work in Yosemite National Park was in the most unusual rescue, last July, of Terrence Hallinan, 12 years old. Thrown from a horse near Benson Lake, the boy suffered a severe brain concussion and could not be moved out safely in any other way.

WASHINGTON OFFICE REORGANIZED

The establishment of an additional Assistant Director position and three new divisions, and the reallocation of general supervision, on behalf of the Director, of the work of all divisions to the Associate Director and two Assistant Directors were the most important features of a reorganization of the Washington office, which was made effective during the past year. Conrad L. Wirth, who had headed the Land and Recreational Planning Division, is the new Assistant Director. An Audit Division was established to handle audits both of concession accounts and reports and of the Service's field accounting offices. James B. Robinson, former Assistant Chief of Public Services, was made Chief of the Audit Division. A Land Planning Division and a Recreational Planning Division were established out of the Land and Recreational Planning Division. Charles A. Richey, who had been Assistant Chief of that Division, became Chief of Land Planning, and Special Assistant to the Director Ben H. Thompson was transferred to the position of Chief of Recreational Planning.

General supervision of the Planning and Construction, Land Planning, Public Services, and Safety Divisions was assigned to Associate Director Demaray; of the Forestry, Legal, Audit, Fiscal, Personnel, and General Services Divisions to Assistant Director Tolson; and of the History, Information, Natural History, and Recreational Planning Divisions to Assistant Director Wirth.

THE PARKS OF THE NATIONAL CAPITAL

The parks of the National Capital, including a considerable acreage lying outside of the District of Columbia, comprise one unit of the National Park System. The office of National Capital Parks also administers several additional units of the System such as the Lincoln Memorial, Washington Monument, Lee Mansion, and Thomas Jefferson National Memorial.

Events of the past year worthy of mention include the transfer of the Suitland Parkway to National Capital Parks jurisdiction; the virtual completion of the Rock Creek Park Amphitheatre, seating 4,000, in connection with the Washington Sesquicentennial; an extensive program of improvements at Great Falls on the Chesapeake & Ohio Canal; the renovation of the Washington tourist camp in East Potomac Park; the casting of sculptures, through the generosity of the Italian Government, for the Memorial Bridge across the Potomac; and the erection and unveiling of the Artigas statue, facing Constitution Avenue at Eighteenth Street.

All swimming pools operated by the office of National Capital Parks were opened for the season on a completely unsegregated basis and have so operated without incident.

NOTES FROM WASHINGTON AND THE FIELD

1950 eruption of Mauna Loa.—On June 1, 1950, exactly a year after its 1949 eruption ceased, Mauna Loa Volcano, in Hawaii National Park, resumed eruptive activity. This had ceased again on or about June 22. In terms of lava produced, this most recent eruption may prove to be the largest in historic times. At the end of June, the North Kona section of the island remained isolated from South Kona by the third or south flow, still too hot for road crews to cut through or over it. The other two flows which crossed the main belt road had cooled enough to permit rough roads to be bulldozed through them.

Ease of access to the flows permitted thousands of persons to see the molten lava course its way down Mauna Loa's flanks and pour into the sea.

Of related interest is the fact that the seismograph at headquarters in Lassen Volcanic National Park during a 3-week period in March and April recorded more than 10,000 earthquake shocks, the area of disturbance being around the peak itself. At least 8 percent of the shocks were of sufficient intensity to be felt.

The challenge of the mountains.—Rocky Mountain National Park continues to register the largest number of mountain climbers. Longs Peak was climbed by 1,416 persons, of whom 74 went up the difficult East Face. Experienced mountaineers continue to gravitate to Grand Teton, which attracted climbers from 39 States and 9 foreign countries. There, 846 persons, in 252 different parties, registered for attempts at scaling one or more of the 10 major peaks, a considerable increase over the preceding year. At Mount Rainier, 57 percent of those who registered for the summit climb were successful. Twenty individuals, in three parties, reached the top of Devils Tower. Winter ascents at Grand Teton, Rocky Mountain, and Lassen Volcanic increased considerably.

In general, mountaineers have accepted the regulations covering ascents of major and difficult peaks, and few exceptions are taken to the registration and equipment inspection requirements. Not a single fatality was reported among the thousands who made regular approved ascents of major peaks. However, there were three fatalities among unregistered climbers at Yosemite, and two among hikers. Six climbers sliding on snow banks were injured at Rocky Mountain. Seven men who had been cautioned not to attempt the Mount Rainier climb because of insufficient experience and equipment were apprehended and fined for undertaking the climb without permission.

Last October two young men became separated and lost from their Colorado A & M Hikers Club party in Rocky Mountain and have not been found.

Centennial observances at Death Valley.—Attracted by a pageant depicting the Death Valley crossing by the emigrant parties of 1849, and the saving of the Bennett-Arcane party, an estimated 65,000 persons entered Death Valley National Monument on December 3, though only about 35,000 were able to reach the pageant scene on time. Held in Desolation Canyon, the pageant was featured by the 36-piece Hollywood Bowl Orchestra, the 100-voice Redlands Choral Group, and the first performance of "Death Valley Suite," written and conducted by Ferde Grofe for the occasion. The event was sponsored by the Death Valley 49ers, Inc., a volunteer organization composed of the supervisors of Inyo, Kern, San Bernardino, and Los Angeles Counties, the Automobile Club of Southern California, several prominent historians, and other interested citizens.

As part of the California Centennial observance, three historic landmark plaques, furnished by the State, were dedicated at appropriate locations in the monument.

Advisory Board chooses new officers.—With the resignation of Dr. Waldo G. Leland from the Advisory Board on National Parks, Historic Sites, Buildings, and Monuments, after 4 years of extraordinarily effective service as its chairman, Charles G. Sauers, superintendent of the Cook County (Ill.) Forest Preserve, was elected to succeed him at a meeting of the Board in April. Dr. Theodore G. Blegen, dean of the Graduate School at the University of Minnesota, was chosen to succeed Mr. Sauers as vice chairman. Dr. Frank M. Setzler, head curator of anthropology, United States National Museum, was reelected secretary.

A second vacancy in the membership of the Board was created by the resignation of Mrs. Reau Folk, Nashville, Tenn., former regent of the Ladies Hermitage Association. At the year's end, neither vacancy had been filled. Dr. Leland will continue his distinguished service as a collaborator of the National Park Service.

Glacier National Park economic survey.—The Bureau of Business and Economic Research of the University of Montana acted as consultant on a pilot survey of Glacier National Park visitation during the summer of 1949, to determine the economic value of Glacier

National Park to the State. Of particular interest is the fact that 75 percent of all the parties surveyed stated that they came to Montana primarily to see Glacier National Park.

Fort Sumter explored for live ammunition.—The Service cooperated with the War Trophy Safety Committee in a public demonstration of mine detection to uncover still unexploded Civil War ammunition at Fort Sumter National Monument on August 20, 1949. High officials of the armed services, the Treasury Department, and the National Rifle Association participated in the demonstration, which included the detonation, under the direction of a Navy expert, of Civil War shells found on the area. It was designed primarily to focus public attention on the desirability of having live ammunition war trophies deactivated.

Travel records again broken.—Travel to all areas administered by the National Park Service, during the travel year, October 1, 1948, to September 30, 1949, with a total of 31,864,180, exceeded that recorded for the previous year by more than 2,000,000. For the succeeding 9 months, the total was 16,433,044, an increase of 1,762,023 over the same 1948–49 period. Excluded from this comparison is the count of 1,980,876 visitors at Lake Texoma, since that area reverted to Corps of Engineers administration on July 1, 1949.

Revenues.—The National Park Service total receipts from revenues during the 1950 fiscal year again set a new record. They were $3,527,606, a gain of $60,000 over 1949. Income from fees collected from visitors was $2,946,202.

United States Travel Division ceases operation.—Reestablished at the beginning of the 1948 fiscal year, the United States Travel Division was compelled to discontinue its operations on October 1, 1949, since the 1950 appropriation act contained no funds for it. Under the direction of J. Lee Bossemeyer, who had been connected with the prewar United States Travel Bureau, the Division had established an enviable reputation for cooperation and usefulness among both public and private travel agencies. Its monthly publication, Travel U. S. A., was in great demand, as were the other excellent publications which it had produced in its brief career.

Airport legislation.—Thanks chiefly to the cooperation extended by the Civil Aeronautics Administration, the Department was successful in obtaining legislation which granted it the authority to participate with other agencies in the development of airports, outside of the national parks, to serve these areas. One of its important results should be to relieve the pressure for the establishment of landing facilities within the boundaries of national park areas, to which, as a general principle, the Service is opposed.

First on the list of locations where adequate facilities are required is West Yellowstone, where existing facilities have proved so unsatisfactory that scheduled air service is no longer provided there. The planned new airport will be outside of Yellowstone National Park.

Paradise Valley Road left uncleared of snow.—With accommodation at Paradise Valley closed during the winter, and skiing activities moved to the other side of the mountain, the road to Paradise Valley, Mount Rainier National Park, went uncleared last winter for the first time since the war. There were extraordinarily heavy snowfalls—102 inches in December and 151.5 inches in January at Longmire; these, combined with a cold spring and late snows, made the task of clearing the road for summer operations unusually difficult.

Jurisdiction suit decided.—Exclusive jurisdiction, ceded to the Federal Government by the State of California, applies to privately owned lands within Kings Canyon National Park, United States District Judge William C. Mathes concluded, in a decision rendered on June 22, 1950, in a suit brought by the United States against Harry T. Peterson. Peterson had been refused a Federal permit to sell liquor on private property in the Wilsonia subdivision, in the General Grant Grove section of the park, but had sold under a State license.

Judge Mathes refused to enjoin Peterson from continuing the sale of liquor. He stated that "criminal sanctions are provided for violation of National Park Service regulations." The State of California, which intervened in behalf of the defendant, is expected to appeal the decision on jurisdiction.

Bureau of Indian Affairs

Dillon S. Myer, *Commissioner*

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RESERVATION DEVELOPMENT

ONE OF THE PROGRESSIVE STEPS in Indian affairs taken last year by the Congress was enactment of the long-range Navajo rehabilitation bill; and appropriation requests to carry out the first year of the program are included in the budget for the fiscal year 1951, amounting to approximately $14,000,000 in cash and $6,000,000 in contract authorizations. The next large rehabilitation bill being considered is the $23,000,000 program for the 7,000 Indians living on the Papago Reservation in southern Arizona. As in the case of the Navajo, this program calls for roads, irrigation and stock-water development, soil and moisture conservation, construction of educational and health facilities, and relocation projects.

Another significant development during the year was recognition by many tribes of the necessity for programing their economic and social needs. In the Southwest, for example, as a result of the passage of the Navajo-Hopi rehabilitation bill, the Apaches, Pimas, Hualapais, and other tribes evaluated the resources of land and water available to them in relation to their growing populations dependent upon these resources.

The results of these analyses were not encouraging. The San Carlos Apaches, for instance, found that their principal resource, about 1,628,000 acres of range land subjected to the hazards of recurring drought and grasshopper infestations, could not safely support the present estimated grazing capacity of nearly 28,000 cow units. Recognition of this fact induced the San Carlos Apaches to give intensive attention to the formulation of plans and programs for the future of the tribe.

The White Mountain Apaches are in about the same position. Their number is increasing, and the pressure on the available range is mounting. Even though the White Mountain Apache tribal forest is certain to produce an annual safe sustained-yield cut of 28,000,000 board feet, the revenue from this forest goes to the tribe in the form of stumpage, and the individual benefits only by the employment opportunities created in the logging camps and sawmills. Here, also, a beginning is being made in considering the future of the tribe in the light of its available resources.

On the Hualapai Reservation in northern Arizona, a 10-year drought has compelled a reduction of the tribe's principal asset, cattle, from 7,400 head to 2,500 head. Even this small number necessitates constant hauling of water to the animals to keep them alive.

On the Colorado River Reservation, extension of the irrigation distribution system, subjugation and seeding of the newly irrigated land, and its colonization by Navajos and Hopis proceeded at a lively pace. On June 30, 1950, there were 174 Navajo and Hopi families operating 40 very productive acres per family in alfalfa. On the northern reserve more than 7,600 acres has been similarly subjugated and seeded for the benefit of the Mohaves and Chemehuevis.

The year was one of progress in planning for resources use as the tribes of the Southwest prepared themselves increasingly to participate in the economic and social life of their communities and the State and Nation.

On August 13, 1949, President Truman signed a bill providing for consolidation of Pueblo Indian land units for grazing purposes through exchanges with non-Indians. The act vested in the Pueblos title to the submarginal lands purchased in the thirties for their use. Over 609,713 acres of Indian-used land were thus put into more effective use and more efficient administration.

During the year congressional authorization was obtained for a joint county-Indian hospital to be built in Albuquerque, Bernalillo County, N. Mex., under Federal-county contract and to be used by both Indians and non-Indians. This hospital is to replace the present obsolete one in Albuquerque, with provision for an increase in Indian beds and a greater variety of medical services to the Indians. The All-Pueblo Council, by resolution, formally approved this forward step for cooperation with non-Indians.

On December 5, 1949, Laguna Pueblo adopted its new constitution—drafted without agency participation. Isleta Pueblo, during the year, found agreement for new court procedures, new distinctions between administrative and criminal law, and extended police responsibilities. The Pueblo governor himself arranged for the Federal Bureau of Investigation to give Pueblo police instructions in the law and in their powers.

San Ildefonso Pueblo, after 3 years of discussion about previous compromise agreements as to Pueblo government, found its own new working basis for agreement between the two disputing factions. While that Pueblo still has many details of its business operation to iron out, there is a greater basis of common understanding about that Pueblo's political procedures than has been true since the early 1930's, when the factional split resulted in unilateral action first by one faction and then the other.

United Pueblos Agency, acting to make certain that Indian water rights would be protected, was able not only to achieve its purpose but helped the Atomic Energy Commission at Los Alamos to find more economic sources of water supply than at first seemed likely to be found.

Various pueblos contributed substantially to repair and maintenance of their water-supply facilities. The Mescalero Apaches made possible the continuance of managerial program for their cattle herds by offering to contribute, if necessary, to deficient funds.

Pueblo Indians from as far as Isleta and Zuni, together with Navajos and Hopis, answered the Bureau of Land Management call to fight a series of the most critical forest fires New Mexico has ever known.

Land-leasing activities in the pueblos increased through the year, covering a wide range of business projects, ranging from sand and gravel permits to a drive-in theater which the Indians of Tesuque Pueblo may one day, under their contract, themselves be managing.

The era of stock reduction and the sudden upsets in Navajo economy, occasioned both by the conservation measures and the war, left in their wake a distrust of Government on the part of the Navajo people. At the beginning of the past fiscal year, one of the first problems was that of reestablishing the confidence of the Navajo people in the Government. The degree to which that was done in a period of 12 months is a major accomplishment, and one that has already born fruit in terms of real progress.

As early as the November 1949 tribal council meeting, it was evident that the Navajo people had decided to give the new organization a fair trial. They accepted proposed modified procedures presented as a means for expediting tribal business, and attacked the long-standing impasse between Indian traders and the council in connection with revision of trading regulations. The leaders and the people even took the initial steps in the matter of giving constructive consideration to the issue represented by the necessity for revising the grazing regulations on the reservation.

The advisory committee of the Navajo Tribal Council, functioning as a credit committee, last year granted a total of $203,620.76 in individual loans to Navajos. Loans ranged from less than $100 to sums in excess of $1,000, and were used for such purposes as education, the purchase of seed, machinery, and livestock, refinancing and establishing trading posts, restaurants, and other businesses, and for making various improvements. In all, operating on a capital of $295,977.28, the revolving-credit fund has made it possible for some 268 individuals to establish themselves in business, or otherwise better themselves economically. Responsibility for making sound loans has rested largely on the shoulders of the advisory committee of the Navajo Tribal Council, and at the close of the 1950 fiscal year $27,180.11 had been repaid. This is a real start in the problem of developing practical substitutes for the old livestock economy, as well as a valuable exercise in economic responsibility.

Development of the latent physical resources of the Indians throughout the country is being hastened. Indian land is being brought under irrigation to protect their water rights, as well as to increase yields and convert large blocks of grazing land into productive crops. They are being provided with increased economic opportunities through industrial and agricultural development of their resources and adequate training programs to fit them for employment in skilled occupations off the reservations. There is opportunity for a wide expansion of cattle herds, establishment of small businesses, initiation of sawmill enterprises to market Indian timber, and many other methods of increasing Indian income.

With a well-rounded program pointing toward these objectives, there appears to be no reason why the Indians cannot adjust themselves to the utilization of their resources at a level which will provide an adequate standard of living and in an environment which will gradually transfer to local agencies many of the responsibilities which the Federal Government is now exercising.

FEDERAL WITHDRAWAL TO BE SURVEYED

One of the significant planning steps during the past year was the introduction by Congresswoman Reva Beck Bosone of Utah, on June 21, of the joint resolution authorizing a study of the country's approximately 260 tribes, bands, and groups of Indians, to determine their qualifications to manage their own affairs without supervision by the Federal Government.

It was made clear at the time that any proposed solution which would result in exploiting Indian groups by the precipitate withdrawal of guaranties protecting property rights, or the termination of Federal services in advance of others being made available, would be disastrous.

Because of the many different cultural patterns, various treaty provisions, and past history of exploitation, attempts to solve intricate human problems by resorting to hurriedly conceived and unrelated projects, there now exist many complex problems of Indian administration. With our present-day concepts of furnishing basic education for all, minimum health and sanitation standards, the importance of the right of each individual to a decent standard of living, and the numerous other things to encourage individual initiative and independence, the problems are in many ways more complex than ever and solution of these problems would not be advanced until the Indian people are moved to accept their status along side their non-Indian neighbors.

These problems require careful marshaling and sifting of available facts, the gathering of new facts where needed, the consideration of these facts and opinions by well-qualified persons in and out of the Government, so that the Government and the Indian groups may work cooperatively for the future. This approach is necessary in order to develop constructive programs generally acceptable to the Indians and others.

BUREAU REORGANIZATION

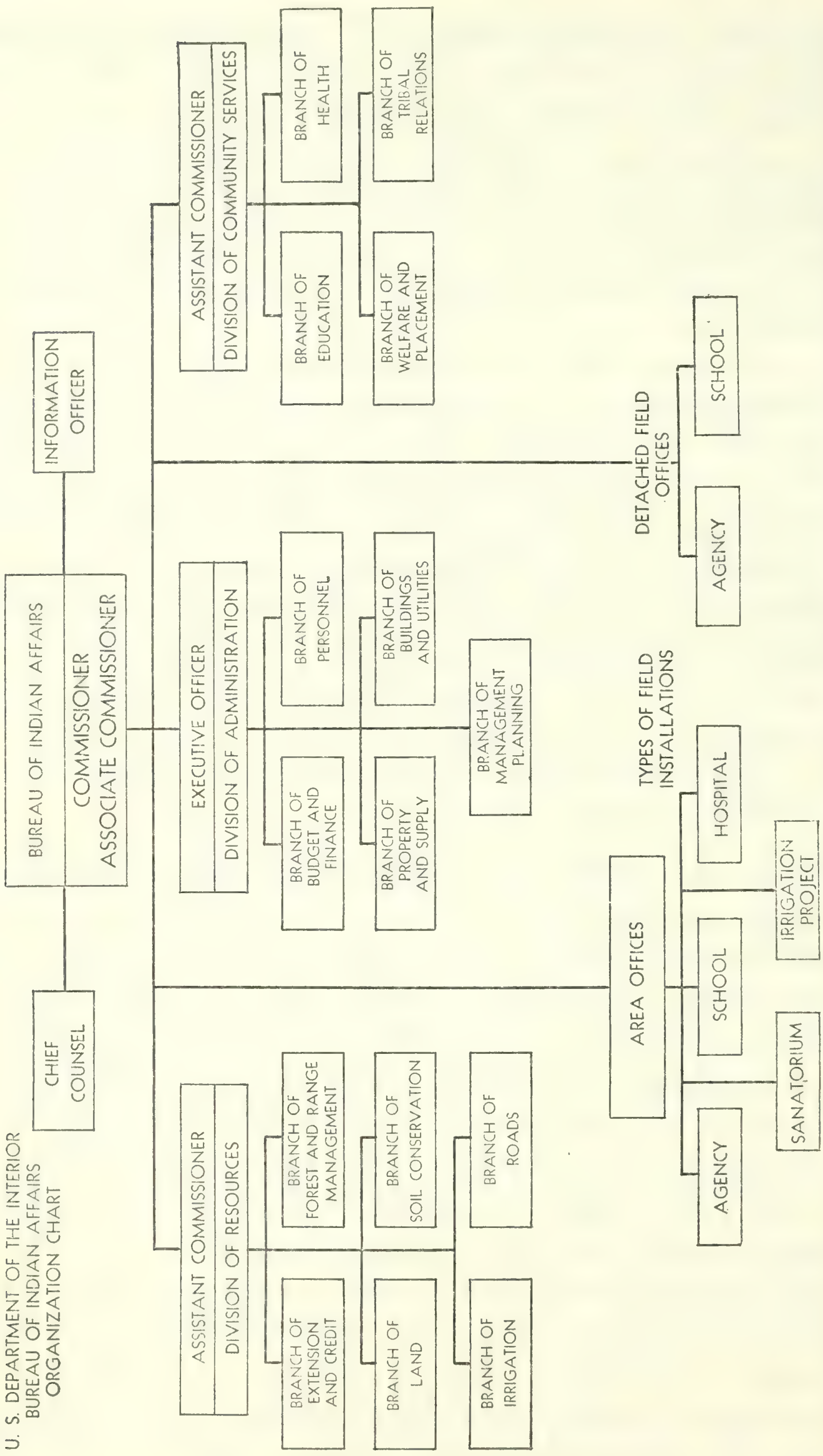
The past year saw placed into effect a great change in the basic organization of the Bureau. The plan now in effect is the result of several years of analysis and discussion. It provides three areas of operation: (1) Washington, headquarters office; (2) area offices; and (3) field offices, see chart on page 344.

Necessitated by many factors, the reorganization was primarily caused by the inability of the Washington office to deal effectively with more than 100 field offices. The first phase of the reorganization has been accomplished and the areas of responsibility and internal relationships have been announced. The second phase, which involves carrying out the plan at the field level, has been accomplished at many of the major installations. It is anticipated that this phase will be accomplished early next year.

NEED FOR EXPANDED INDIAN HEALTH PROGRAM

Comparative morbidity and mortality reports among Indians from decade to decade show that considerable progress is being made in the improvement of the health of Indians as a group. Nevertheless, the efficiency of the Indian health program from year to year, as reflected in mortality rates, fluctuates in direct relation to (*a*) professional personnel available to serve the Indians, and (*b*) funds to make possible full utilization of hospital and other health facilities for Indians.

Since early in World War II, there has been a shortage of both funds and personnel to operate the Indian hospitals to capacity. Also, except for a field nursing service, no provision has ever been made for carrying out among the Indians, preventive medicine essential for the control of many diseases. Until provision is made for employment of personnel in the improvement of environmental sanitation on Indian reservations, dissemination of health education, and for carrying out prenatal, nutritional, or infant and maternal hygiene services, the death rate among Indian infants and children as a group will continue to be high, proportionally about five times that of the general population.



U. S. DEPARTMENT OF THE INTERIOR
BUREAU OF INDIAN AFFAIRS
ORGANIZATION CHART

Hospital and Medical Care

As of June 30, the Indian Service was operating 71 hospitals, varying in bed capacity from 15 to 420. During the past fiscal year one hospital unit of 200 beds was completed at Mount Edgecumbe, Alaska, almost doubling the bed capacity in that institution. Also, construction was begun on a new 400-bed hospital at Anchorage, Alaska, of which 100 will be for tuberculous patients. During the year construction was started on a 100-bed addition to the Galen (Mont.) Tuberculosis Hospital, for which Congress provided $1,500,000 last year. This will be completed during fiscal year 1951 and will provide beds for tuberculous Indians. It will be operated by the State of Montana on a per-patient-day cost basis.

Hospital Personnel

Throughout the year recruitment of professional personnel continued to be difficult, and the turnover was heavy. Factors contributing to the heavy turnover of both medical and nursing personnel were: Inadequate salaries, isolation of areas, long hours of work, lack of recreational facilities, and inadequate modern professional equipment for many of the smaller hospitals.

For proper medical and public-health care, there should be a minimum of two physicians assigned to each hospital. Yet, for lack of living quarters at these isolated stations, it will be impossible to assign a second physician until such time as additional quarters are constructed. About 45 quarters are urgently needed for medical and dental personnel.

Professional personnel employed at the beginning and close of fiscal year 1950 was as follows:

	July 1, 1949	June 30, 1950
Total physicians employed in United States	94	102
Total physicians employed in Alaska	8	10
Total	102	112
Nurses employed for hospital duty (in United States and Alaska)	686	805

The net gain of physicians during the year was only 10. There have been 26 full-time medical officers separated from United States and Alaska activities during the same period. A total of 145 positions was allowed for full-time physicians under 1950 budgetary limitations. The number of vacancies existing at the close of the year was 33. A total of 250 physicians is needed to properly staff all hospitals and field programs. Of the 112 physicians employed at the close of the year, 95 were assigned to hospitals and 17 were employed in various field services.

During fiscal year 1950 there was a marked gain in the number of nurse positions that were filled:

	July 1, 1949	June 30, 1950
Nurse positions	791	910
Nurses employed	596	805
Vacancies	195	105

The above figures represent all nurses employed, including both hospital and field (public health) nurses. It will be seen that there was a net gain of 209 nurses employed during the year. The number of field (public health) nurses employed at the beginning and close of the fiscal year was 51 and 83, respectively—a net gain of 32, as compared to a net gain of 177 nurses employed for hospital duty. The 910 nurse positions, as of June 30, include 46 new staff nurse positions for service at Mount Edgecumbe Medical Center.

ENLARGING EDUCATIONAL OPPORTUNITIES

The Federal Government has long assumed a treaty or other responsibility for the education of Indian children in order to help them to become more self-sufficient and eventually to fit them into the general pattern of American life. To meet this obligation, the Federal Government operates boarding and day schools, or, in cooperation with the public school districts of many of the States, arranges for the education of Indian children in available public schools.

In the past there has often been a tendency to assume that Indians are incapable of making the best use of their resources. There is no longer any justification for assuming that they are incapable of adjusting to the American economy. During the time when little was done to train them in the skills necessary to farm, raise cattle, and work with machinery, it was entirely natural that many Indians who had been reared in the older culture patterns should feel more secure in attempting to continue to live in terms of these culture patterns.

Today, most Indian children are attending Federal or public schools in about equal proportions. There is quite a difference, however, in the background and culture pattern of these two groups of Indian children. The term "Indian" in both legislative enactments and in Federal services embraces all Indians from full-bloods down to a dilution of one-fourth degree of Indian blood.

Full-blood Indian children usually come from homes in which an Indian language is still spoken, and from association with parents and grandparents basically devoted to Indian traditions and an Indian way of life. Most of these full-blood youngsters attend Federal schools.

On the other hand, Indians enrolled in public schools are, for the most part, of mixed-blood families where the white cultural influence comes from a white mother or father, and as many as three white grandparents. Such children usually speak English, have experienced the basic cultural pattern of the non-Indian community, and are likely to be found attending public schools, because they live on reservations which were "opened" long ago, resulting in communities where whites intermingled with Indians and where public schools are in operation.

The full-blood child not only comes to school speaking an Indian language, but without the vast variety of social, emotional, and ethical experiences common to members of the non-Indian community. The quarter-blood finds many of the experiences which will lead to his assimilation and continued identification with a non-Indian community present in his own home; while the full-blood child comes from a home in which much customary "American behavior" is lacking.

INDIAN EDUCATIONAL POLICY

The Federal Indian school, therefore, has become a basic assimilative influence in the lives of the full-blood children. Its job is not alone to teach the three R's in accordance with the public-school pattern. It has a much broader and more important responsibility:

To teach the use and understanding of the English language; to present, through the school, experiences in preparing and serving meals, in dressing, and in personal cleanliness; in the care and training of livestock; in the preparation, care, harvest, and preservation of new types of garden and field crops; and in the use and maintenance of new tools, new materials, and new machinery.

All of these disciplines the average non-Indian child simply acquires from living among adults and from performing the everyday chores of the American farm or home. These things are so much a part of the daily cultural experiences of most rural non-Indian children that they are not taught in the public schools, but are acquired in the home. Indian schools devote a considerable portion of their school day to providing such assimilative experiences, in addition to the three R's of the public schools. Tests recently administered in Federal and public schools prove that Indian children in Federal schools, as a result of this type of instruction, are acquiring many of these skills which they would otherwise lack.

In addition, the Federal high schools are offering training in vocations designed to do one or both of two primary things: (1) Prepare the children for the best use of the resources of their Indian lands, i. e., teach them agriculture, stock raising, and similar skills, or (2) train them in the mechanical or industrial skills necessary to obtain employment away from the reservation areas. In view of the fact that large numbers of Indian school children are born in areas where the Indian population has outstripped the resources to the point that these will no longer support the population, it is important that many Indian youngsters find employment elsewhere. Many Federal Indian schools are making real progress in preparing and placing such students in off-reservation employment.

Much has been said of the desirability of training many Indian young people in colleges or advanced schools to furnish the skilled leadership for further advance. Today, all 33 Federal Indian high schools are accredited by the States in which they operate, and approximately 20 percent of their graduates go on to advanced education. This is in contrast to about 35 percent of the average high-school graduates which go on to college. The number of Indian high schools has increased in the last 25 years from 2 to 33; and, since the last war, the number of Indian students attending high school has quadrupled. A higher proportion of full-blood Indian students remain to graduate from Federal high schools than from public high schools, and, similarly, a larger proportion now proceed to college.

During 1950, the number of Indian children in average daily attendance in Federal schools increased to 26,716 from a total of 25,201 in 1949. More than half of this increase was in children from the Navajo Reservation. Eight hundred and forty-two more Navajos are being cared for in off-reservation schools, and 44 more in reservation schools.

Since the Congress evinced concern for the education of Navajo children in 1947, 2,682 Navajo children over 12 years of age, who had never been to school and who did not speak English, have been admitted to 10 off-reservation schools. The largest of these, the new Intermountain Indian School at Brigham City, Utah, was opened on January 9, 1950, for 542 children, about one-fourth of its ultimate capacity. In the fall of 1950, about 1,300 will be accommodated, and a year later, when new construction is complete the full 2,000 will be cared for.

During 1950, the first of the reservation day-school conversions planned under the Navajo-Hopi rehabilitation bill was completed, with the construction of dormitories at the former Coyote Canyon Day School; work was under way on new dormitories for 120 children at Tohatchi, a day school which was closed in 1946 because of contamination of the water supply; the first dormitories of the new Shiprock School were placed in use on January 3, 1950, and funds were provided in the 1951 appropriation act to bring this new plant to near completion as a 700-pupil boarding and day school during 1951.

STATE-FEDERAL RELATIONS

With the negotiation of contracts with the States of Idaho and South Dakota during fiscal 1950, all but one of the States enrolling large numbers of Indian children in their public schools are now under contract with the Indian Service for such Federal assistance as may be justified by local conditions.

During the year the Commissioner of Indian Affairs pointed out, and the Senate Committee on Appropriations confirmed, the fact that "Indian children by virtue of their citizenship in a State or residence in a State and district are entitled to the same free public education as rendered to any other citizen children without any legal obligation resting on the Federal Government to pay tuition for this service." The Senate committee went on to state, "However, the committee also recognizes that the presence of large blocks of nontaxable Indian land within a local district or unusually large numbers of Indian children may create a situation which local funds are inadequate to meet." The committee, therefore, endorsed the policy of the Indian Service in providing financial assistance to these districts "based on evidence that the district is taxing itself to the maximum, and is still in need of supplementary funds in order to maintain an adequate school."

In view of the fact that the State school laws vary from State to State, and that a great variety of financial patterns exist by which the cost of education is shared in different degrees by States and local districts, the manner and amounts of Federal aid to Indian schools will differ. Within these various structures, however, the principle upon which Federal assistance is granted will remain uniform.

With minor exceptions, Indian children are now attending public schools where such schools enrolling white children are sufficiently close to Indian areas to permit the enrollment and transportation of Indian children. Contrariwise, some public schools on the reservations have almost exclusively Indian enrollment. Federal day schools are now operated in Indian areas where there are few or no white children and where there is no tax base for a public school. Indian elementary boarding schools are operated to care for dependent children for whom no other constructive provision can be made, and Indian boarding high schools are operated for such dependent children, and for children of high school age who cannot attend on a day basis because of isolation; or when they need vocational training which cannot be obtained in available public high schools. While the number of non-Navajos in Federal schools is decreasing each year, the tremendous reservoir of Navajo children (about 15,000) for whom no school facilities exist, has resulted in the filling of pupil vacancies in Federal schools as rapidly as these occur.

In keeping with the recommendations of the Secretary's report on the Navajo, which stated that the reservation resources, if developed to the full, offered economic opportunity for about 35,000 out of the total Navajo population of 65,000, the Federal off-reservation education of Navajos is directed entirely toward the preparation of these children for permanent off-reservation employment. In 1945, the reservation schools were caring for approximately 5,000 children, with another 1,500 in mission and public schools, out of 24,000 Navajo children between the ages of 6 and 18. There was thus a group of about 12,000 over 12 years of age who had never been in school, and who had no knowledge of English. If nothing was done for this group, they would continue into adulthood as illiterates unable to communicate with the rest of America. Since then, places have been provided in off-reservation schools for almost 4,500 of these children, who eagerly seized the chance to obtain schooling, and who maintained an almost perfect attendance record. A special school program has been planned for the older class (above age 12) of these children, compressing into 5 years the acquisition of the ability to speak and think in English, the ability to read and write, and deal with simple numbers, some familiarity with health, sanitation, history, geography, civics, and science; and a thorough grounding in at least one vocational skill. Where these children are enrolled in off-reservation schools, a continuous program has been maintained to enlist the cooperation of farmers, businessmen, and others of the adjacent area in finding opportunities for permanent employment for these children at the end of the training.

INDIAN WELFARE AND EMPLOYMENT

During the fiscal year 1950, a milestone was reached in the welfare program for Navajo and Hopi Indians with passage of the Navajo-Hopi Rehabilitation bill. The bill carried a controversial provision for additional Federal contribution to the Arizona and New Mexico Departments of Public Welfare for public-assistance grants to Navajos and Hopis above amounts to be paid the States under the Social Security Act. More than 5,000 Indians will be affected by this law.

Still to be resolved is a similar controversy regarding responsibility for public assistance under the Social Security Act for an additional 2,000 reservation Indians, other than Navajo and Hopi, in the States of Arizona and New Mexico.

A noteworthy step was also taken in the provision for adequate general-assistance grants to Navajos and Hopis ineligible for public assistance made possible during the fiscal year by increased funds.

For the second winter in succession severe and prolonged blizzard weather in the Midwest and Northwest caused an emergency relief situation for more than 10,000 Indians. Depleted welfare resources necessitated a supplementary appropriation, as well as use of surplus commodities in carload lots. More adequate funds requested in the 1951 welfare appropriation, together with placement of more employables in gainful occupations, should reduce the relief needs during the coming year.

While Indian labor, though small in comparison to the total manpower throughout the Nation, made a significant contribution in meeting the needs of the country during World War II, it is not at present being used to its maximum capacity. The reasons are understandable. Indians have their homes, for the most part, in areas not easily accessible to industrial opportunities; employment off of the reservations consists mainly of seasonal agricultural employment. This results in low incomes per year for the families who are dependent upon outside employment.

Congress recognized the problem by making $100,000 available for a placement program. The money was not available, however, until October 1949, and it was January 1950 before placement officers were in the area offices.

During the first phase of the developing program, stress was placed upon cooperative agreements with Federal and State employment services to assure registration, proper classification, and referral to jobs. Such agreements have been reached with the following States: Arizona, New Mexico, South Dakota, North Dakota, Nebraska, Minnesota, Oregon, Colorado, Utah, and Idaho. Discussions were under way in the spring of 1950 with Wisconsin, Montana, Washington, and Oklahoma, although the four latter States were already carrying out the substance of the formal agreements. In addition, a formal agreement was concluded with the United States Employment Service of the Department of Labor. Plans for analyzing employers' needs and developing interest within the reservations were also made, although the effectiveness is limited by the small staff and large geographic area.

During the 6 months upon which a report can be made several factors came to light. The severe winter and late spring made even seasonal employment difficult in the whole northern tier of States. Also, few Indians on the reservations at present are highly skilled. There is, therefore, a definite need to develop opportunities for training more skilled workers, preferably through apprenticeship or other on-the-job training programs. Employers, for the most part, find Indians quick to learn and satisfactory employees.

As a substitute for the livestock economy, off-reservation employment is rapidly taking its place in the changing Navajo way of life. An increasing number of Navajos are seeking such employment, and employers are reporting better work performance with less turn-over in personnel. In all, about 14,000 off-reservation jobs were filled by Navajos during the 1950 fiscal year, mainly in agriculture and railroad work.

In connection with off-reservation employment several important cooperative agreements were reached with State employment offices. Arizona sent one of its employment officers, with a trailer, over the reservation to catalog Navajo-Hopi skills. The Arizona and New Mexico Employment Security Commissions authorized the taking of unemployment-insurance claims by Navajo and Hopi placement assistants, and the States will set up itinerant service on the reservation. Both agreed to give complete testing, guidance, and counseling service to Indian students in the Albuquerque and Phoenix Boarding Schools, and to try to find suitable employment for them upon graduation.

In California and Nevada, regional committees were established, comprising representatives of industry, agriculture, management, the unions, and civic groups, for the purpose of promoting and extending Navajo-Hopi employment opportunities, with especial reference to graduate Indian students from California schools.

Continued off-reservation employment, together with growing interest in Navajo problems on the part of the community, will be instrumental in broadening the scope of Navajo participation in the activities of life away from Navajo land, and should ultimately provide a basis for economic independence for a large part of the population.

NATIONAL INDIAN INSTITUTE

In 1941 the Congress ratified an international treaty establishing an Inter-American Indian Institute, and pursuant to article X of the treaty, the President issued an Executive order creating the National Indian Institute.

During its first years, the National Indian Institute was financed through the Office of the Coordinator of Latin American Affairs. In 1945 responsibility for the institute was delegated to a private research agency by order of the Secretary of the Interior. In fiscal 1950 Congress for the first time approved a direct appropriation for administration of the institute within the Bureau of Indian Affairs. Funds became available in October and the transfer was effected in December 1949.

During the past year the institute's staff participated in the Second Inter-American Indian Conference, Cuzco, Peru; aided in stimulating research among public and private agencies on Indian affairs; assisted in the exchange of Latin-American students; and maintained liaison with the eight Latin-American countries with national Indian institutes.

INDIAN LAND STATUS

The fiscal year saw many Indian land transactions, most of them involving the removal of Indian land from a trust status. These included the issuance of 605 patents in fee totaling 96,555 acres, 68 sales by deed covering 7,177 acres, and the removal of restrictions in 18 instances covering 1,398 acres; also the taking of Indian lands for public purposes.

Fort Berthold

The largest and most important land transaction of the year was the loss of 155,000 acres of land by the Three Affiliated Tribes of the Fort Berthold Indian Reservation in North Dakota. This huge area, the productive bottom lands of the reservation, was taken by the United States Corps of Engineers for the construction of the Garrison Dam and Reservoir on the main stem of the Missouri River. The act of October 29, 1949 (Public Law 437, 81st Cong., 1st sess.), provided $12,605,625 to compensate the tribes and individual Indians for the loss of their lands, improvements, timber, and minerals, as well as the costs of the relocation and land adjustment which will be necessitated by the inundation of the bottom lands of the reservation. Some 300 families must move away from the future reservoir site. Public Law 437 was based upon a contract signed in 1948 between the tribes and the United States. Although the terms of the contract had been fully embodied in House Joint Resolution 33 as introduced, the act as finally passed omitted several features, principally power and hunting and fishing rights, which are of major significance to the Indians. Nevertheless, on March 4, 1950, a majority of the Indians voted to accept the provisions of the act and on that date its terms became effective. The Indians still hope, however, to regain through amendatory legislation at least some of the rights to which they believe they are entitled under the terms of the 1948 contract. Meanwhile, the Bureau is working closely with the tribal council on the many complex problems of relocation which must be solved before the closing of the Garrison Dam, now scheduled for the autumn of 1952. The tribal council has shown excellent judgment in planning the use of the funds made available by Public Law 437.

Alaska

In November 1949 Secretary of the Interior Krug designated native use areas, subject to the approval of the native residents, for the native communities of Barrow, Shungnak-Kobuk, and Hydaburg. In the elections, the Hydaburg Reservation was accepted, while the Barrow and Shungnak-Kobuk Reservations were rejected by the native residents.

Indian Tribal Claims

There was increased activity during the fiscal year with respect to the prosecution of tribal claims filed pursuant to the act of August 13, 1946 (60 Stat. 1049). This act, which established the Indian Claims Commission, provides that all claims must be filed within 5 years from the date of the act. Hence only 1 year remains for the filing of claims with the Commission. Approximately 70 petitions have now been filed. About 65 attorney contracts for the prosecution of tribal claims and general counsel services were approved during the last year. Cases now pending in the Indian Claims Commission include those of the Choctaws, Chickasaws, Mississippi Choctaws, Assiniboines, Pawnees, Kaws, Confederated Salish and Kootenai Tribes of the Flathead Reservation, Chippewas, and Apache Nation, as well as other Indian tribes or groups.

Mineral Development

There is no sign of slackening of the accelerated pace of exploration of Indian lands for oil and gas that has prevailed since the end of World War II. As a result of geological and geophysical work by major oil companies, high bonuses have been paid for leases on three reservations on which there had been no previous development. Two units comprising 37,500 acres of Fort Peck land, Montana, were sold for $287,000. Leases were sold on 24,680 acres of Jicarilla tribal land in New Mexico for $246,941. On the Uintah and Ouray Reservation, Utah, leases covering 31,742 acres were sold for $596,553.

One of the outstanding developments was the approval of the large North Burbank water-flood repressuring project on the Osage Reservation, Okla. Following this approval there has been a strong interest in obtaining Osage leases for repressuring projects. Several projects have been approved and others are pending. The Bureau of Indian Affairs is charged with the administration of approximately 10,000 oil and gas leases covering almost 1,500,000 acres. The total output of Indian oil wells exceeded 23,000,000 barrels during the fiscal year. Oklahoma continues to lead in production from Indian lands.

Land Legislation

In this as in other recent years the majority of bills in the Congress which concerned the Bureau involved Indian lands. A number of land bills were approved, the more important of which were the following:

The act of October 29, 1949, previously mentioned, which provided for the taking of some 155,000 acres of land on the Fort Berthold Reservation for the construction of the Garrison Reservoir.

The act of August 13, 1949, provided that 609,713 acres of land in New Mexico are held in trust by the United States for certain pueblos and for the Canoncito Navajo group, located some 40 miles west of Albuquerque. The right of the Indians to continue occupying and using these lands, as they have been on a temporary basis for the last decade, was confirmed. This act also authorized exchanges of lands and interests therein for the purpose of consolidating Indian lands.

The act of October 5, 1949, gave the State of California criminal and civil jurisdiction over the lands of the Agua Caliente (Palm Springs) Reservation in that State. It also provided for the maintenance of the status quo until December 31, 1950, with respect to several hundred revocable permits which had been the subject of litigation in the Federal courts. During the fiscal year the Department continued the allotment of the Agua Caliente Reservation in accordance with the Federal court decisions. A total of 70 allotments had been made by the end of the fiscal year.

On the major land bills, however, no final action was taken by the Congress. Two of these (H. R. 5098 and H. R. 5099), both proposed by the Department, deserve special mention. House bill 5098, which would authorize the long-term leasing of Indian trust land for business, recreational, educational, agricultural, and certain other uses, was passed by the House of Representatives but had not been acted upon in the Senate at the end of the fiscal year. The enactment of this bill would permit the more profitable leasing for long periods of certain Indian lands now limited by law to 5 years for nonirrigable lands and 10 years for irrigable lands. H. R. 5099 would authorize the appropriation of $25,000,000 for the purchase of land by Indian tribes on a reimbursable basis. Such funds would be used by the tribes primarily to acquire Indian lands which have become so fractionated through heirship proceedings as to be unusable by any of the numerous heirs. The purchase of such lands by tribes and their subsequent sale, lease, or assignment in economic units to individual Indians would not only benefit these Indians but would reduce the tremendous leasing and bookkeeping load now carried by the Indian service as a result of the heirship land problem.

EXTENDING ECONOMIC AID

Development of the Indian productive power potential must proceed at a more rapid rate than the Nation as a whole in order for the Indians to play their proper role in America's expanding economy. Generally, the Indian productiveness is not developed to the point of non-Indians in comparable activities, and much of the productive potential is not being utilized. Indians ordinarily do not employ their resources in such a manner as to yield the maximum returns. Their employment of resources, however, is constantly improving and in some instances has reached a point of efficiency comparable to non-Indians in many fields.

The growth of the Indian beef-cattle industry on the San Carlos Reservation, Ariz., both in numbers and quality, is an example of such progress. In the 10-year period between 1939 and 1949 dollar receipts from the sale of livestock and livestock products increased from $508,000 to $1,407,800, or more than 275 percent. These figures are not, of course, entirely comparable because of the decreased purchasing power of the dollar during this period. However, improvement of quality and increased sales account for a large part of the dollar increase.

Beef-cattle operations on eight selected reservations, in the table below, show an increase in inventory between 1939 and 1949 of from 35,250 to 83,315 head, or over 235 percent. Receipts from the sale of livestock and livestock products increased from $639,295 to $4,412,850 during this period, or nearly 700 percent. Again, the figures are not entirely comparable.

	1939		1949	
	Closing inventory beef cattle	Received from sale of all livestock and livestock products	Closing inventory beef cattle	Received from sale of all livestock and livestock products
Colville	5,940	$148,131	7,452	$496,816
Fort Belknap (only)	2,519	35,359	6,156	402,447
Cheyenne River	2,975	21,792	16,819	601,648
Rosebud	5,119	111,390	16,969	991,997
Yakima	5,293	141,689	8,735	333,050
Standing Rock	2,233	28,514	8,517	458,423
Blackfeet	6,739	114,257	14,678	883,447
Warm Springs	4,432	38,163	3,989	195,022
Total	35,250	639,295	83,315	4,412,850

Although Indians are progressing in the use of their physical resources in agriculture, the rate of progress, in general, must be further accelerated in order for them to assume their proper role in agriculture in the expanding economy of the Nation. Far too large a portion of Indian-owned physical resources, adapted to agriculture, are non-Indian in operation. The loss to the total production of the Nation is great because most of these Indian landowners are not otherwise fully employed. Greater utilization of Indian-owned resources by

Indians should release the non-Indian operators for wealth-producing activities elsewhere, employ Indian labor now largely idle, and reduce demands on the national production for relief or other assistance.

Programs for the use not only of physical resources in agriculture but other types of activities as well and fuller employment of human resources are envisaged by pending legislation to promote the rehabilitation of various tribes by providing funds for loans to Indians for development of their resources on a more adequate basis than in the past. Unfortunately, it seemed certain at the end of the fiscal year that the Senate would not act upon any of these rehabilitation bills passed by the House.

Experience with loans from the revolving credit fund authorized by the Indian Reorganization Act indicates that where Indians can be adequately financed, and with proper supervision and training, they can become self-supporting and assume their proper role in the Nation's economy. Without adequate financing, the Indians cannot realize their productive potential. Increased technical assistance also is required.

INDIAN ENTERPRISES

The Indians have demonstrated the progress they can make when financing and technical and supervisory assistance are made availble to them. Properly developed programs will not only enable them to accelerate the progress they are making and contribute to America's expanding economy but will also make possible the eventual withdrawal of Federal services and supervision.

The Tulsa County Indian Credit Association is indebted to the United States for a loan of $43,000. With the help of loans received from the association, and technical guidance and encouragement from extension workers, 39 families have become self-supporting and 6 families partially self-supporting. The average yearly income of these borrowers has increased from approximately $400 to $1,600. At the same time their livestock inventory has increased from approximately 250 hogs and 200 head of cattle to approximately 600 hogs and 1,000 head of cattle. Such assets as farm machinery and farm improvements have increased in even greater proportion.

Again, the Seminole County Indian Credit Association is indebted to the United States for a loan of $65,000. Because of the credit activities of the association, 65 families have become self-supporting and 26 families partially self-supporting. These 91 families have increased their yearly average farm income from $200 to $1,250.

During November 1949 the Menominee tribe of Wisconsin opened a garment factory providing employment for 30 Indian women. Other projects, such as portable sawmills, box factories, and arts and crafts enterprises, are proposed for development during the coming fiscal year.

Also, at Menominee considerable progress has been made in modernizing the tribal sawmill which, during 1950, produced more than 22,000,000 feet of lumber. The dry-kiln capacity has been more than doubled and a pallet plant has been built providing employment for 20 men.

An Indian enterprise established during the past year was the sawmill on the Fort Berthold Reservation, N. Dak., in order to conduct timber salvage operations and to provide a source of lumber in connection with the home-building program on the reservation.

Efforts have continued to assist Northern Plains Indians to improve their economic standards. The number of Indians who own cattle and are farming has increased on some of the reservations. Much, however, remains to be done in this field and the great need is for additional credit funds and a more realistic loaning policy.

DEVELOPING INDIAN RESOURCES

Soil and Moisture Conservation

In the fiscal year 1950 more Indian acreage was planted to leguminous green manure crops than in any preceding year. Also, as much acreage was treated with fertilizers—commercial and barnyard manure—as was treated during the previous 10 years.

Utilization of crop residues, trashy tillage, and stubble mulching were greater than in any preceding year, and amounted to 69 percent of all preceding years.

Land leveling during the past year amounted to 87 percent of the total of all preceding years.

Fields were leveled for more than 1,200 families. Most of the operations were for subsistence farming in small acreages in irrigated areas. The leveled land made for better and easier operation, better use of water, and materially better crops. In terms of helping to improve nutrition, to provide a better standard of living, and to change the outlook of many families, the value of this work is patent.

Proper conservation farm plans under drought conditions are well illustrated by one of the outstanding programs in the country, that at the Northern Idaho Agency. Some of the Indian farms are operating in the second and third cycles of crop rotations.

Here, lands following good conservation practices produced from 40 to 62 bushels of wheat per acre last year, compared with 15 to 35 bushels under the old wheat-fallow system. On these Indian farms a good clover green manure crop had been plowed under; in some instances twice. The effect of the manure crops in increasing absorption and the water-holding capacity of the soil and increasing production from the land removes any doubt of the adequacy of the program. In comparing the past 5 years under soil conserving rotation with a soil-depleting rotation on these Idaho lands, the annual difference in production, on the basis of present prices, amounted to $10.36 an acre or a gain of 21.2 percent.

One of the important soil-conservation projects is the Colorado River Reservation project in southern Arizona where approximately 20,000 of the 100,000 acres have been subjugated. Soil and moisture conservation technicians assisted in constructing the project; and increased the yield of the initial crop planting of alfalfa by 76 percent. The lands are being subjugated for Hopi and Navajo colonists. An area of 7,600 acres was cleared, leveled, and bordered and approximately 4,600 acres were planted to alfalfa to preserve the soil fertility before assignment to individual Indian farmers. Canals and laterals to irrigate the area were constructed and power lines were extended to provide electrical service. The crop of alfalfa is growing on the land at the time the colonists accept the assignment; and this practice greatly adds to the attractiveness of the land to colonists. The fame of the Colorado River Reservation alfalfa has extended to California where commercial consumers are vying with one another for this rich feed.

On the Fort Hall Reservation in Idaho, shortage of winter feed has been the limiting factor in increasing the Indian livestock industry. During the past year a soil survey was made of the rich bottom lands of the reservation and plans were made to increase hay production there.

The 1950 House Appropriations Committee commended the soil-conservation work performed by the Bureau of Indian Affairs. Despite the fine results being obtained, however, the land base is still deteriorating at a faster rate than the reconstruction work.

Schools Teach Soil Conservation

Aside from capital requirements, there is a need for more education in soil conservation, in order to train Indians that they may fully benefit from the technical assistance they receive.

In this connection, the Branches of Education and Soil Conservation cooperated during the year to present, for the first time, courses in soil conservation as an integral part of Indian Service school curricula. Soil conservation will be taught from the lowest to the highest school grades, as well as to adults. The familiarity of the Indian with the land provides a sound basis for instruction. Many Indians become farmers, and it is important that they be shown ways in which to be successful. This includes instruction in land composition, capabilities, and the uses to which lands can and should be put.

Forest and Range Resources

The forest, range, and wildlife resources of nearly 50,000,000 acres of Indian forest and range lands play a vital part in the economy of Indian and non-Indian communities. Forest income provides economic stability to many non-Indian communities and makes a material contribution to the national need for forest products. The continued sustained-yield management of the Indian forest and range resources and their protection against fire, insects, and disease is in the public as well as the Indians' interest. Approximately 45,000,000 acres of Indian range lands provide grazing for nearly 9,000,000 cow-months of grazing.

During the calendar year 1949, approximately 575,000,000 board-feet of timber, with a stumpage value of $5,500,000, were cut on Indian lands. Three Indian sawmills produced approximately 40,000,000 board-feet of timber products. The cut of timber was well within the sustained-yield capacity of the Indian forest. Funds are still inadequate for timber management, as a result of the heavy demands for timber sales and the need for more intensive management.

Grazing was provided for 562,000 cattle, 881,000 sheep, and 103,000 horses. Generally, the forage cover, essential to the future welfare of the livestock industry and soil and moisture conservation, was preserved through proper management. Continued difficulty, intensified by drought, was experienced in the Southwest.

Fish and wildlife with an estimated value of $2,500,000 was taken from forest and range.

Fire protection was provided for nearly 50,000,000 acres of Indian lands. It was necessary to suppress 1,153 fires which burned over 135,000 acres, causing an estimated damage of $207,000. Funds for detection, patron and initial suppression services are still inadequate.

Water Development

On the Wapato irrigation project on the Yakima Indian Reservation, Wash., construction work for the development of approximately 10,000 acres of land on Satus Unit No. 3 was continued during the fiscal year. The area is extremely fertile when provided with irrigation facilities and comparable with the rest of the area, which produced crops valued at $160 per acre during the past year.

On the Flathead irrigation project in Montana, the construction of power lines to meet the rapidly growing demand for electrical service was continued. There still remains, however, a backlog of approximately 800 applications for power service that cannot be filled until additional funds are made available.

In all, irrigation projects embrace approximately 845,000 acres of land, of which approximately 555,000 are Indian-owned and 290,000 are owned by non-Indians. During the past year Indian irrigation projects produced crops valued at approximately $39,000,000.

Roads

Good roads are essential to the conservation and development of the natural resources on Indian lands. They are used to prevent forest fires, other forest depredations, and to harvest forest products. Full utilization of land and water resources requires good roads from markets to irrigated Indian farms. The transportation of mineral products is another important link in the Indian economy.

During the 1950 fiscal year the Indian Service graded and drained 130 miles of roads. One hundred and forty-two miles of roads were surfaced with gravel. Nine hundred running feet of bridges were built. Maintenance operations were performed on 20,500 miles of roads.

Arts and Crafts

Many reservations remain essentially underdeveloped; and many Indian groups find it difficult to gain a livelihood from their limited land resources and must increasingly turn to industry. The development of industrial opportunities on and near reservations, and the shift of a portion of the Indian population from agriculture to industry, should bring about a material improvement in living standards and facilitate the adjustment of the Indians to the social and economic life of the Nation.

The work of the Indian Arts and Crafts Board makes several important contributions to this program. Work centers on several reservations give Indian craftsmen experience in organizing production to meet requirements of modern merchandising. Many new and useful items are being made which, while keeping closely to the Indian tradition, are being styled to meet demands of modern interior decoration and modern dress. Production of a wide variety of modern crafts furnishes the basis for a large number of small industries.

During the past year, the Navajo Arts and Crafts Guild moved into the Church Rock Village and began to make this former war housing project into a crafts village. The village was built to house workers at the Wingate Ordnance Depot. No longer needed for this purpose, it was turned over to the Navajo Tribe, which immediately authorized the expenditure of approximately $25,000 to rehabilitate the buildings. Silversmiths and rug weavers are now living in the village; a quonset hut serves as a workshop; and a volume of fine silver jewelry and rings are being produced. As with all good Indian crafts, there is no problem in finding a ready market for these products. The Arts and Crafts Board supplies management and supervision for this project under a management contract with the Navajo Tribe. The guild however, pays all of the costs.

The Oglala Sioux Tribal Council, in early June, authorized the tribal officers to apply for a loan of $25,000 from the revolving loan fund with which to finance a tribal arts and crafts project, suggested by the Board in April. This project will expand the purchase for resale of traditional Sioux homecrafts and establish two small industries, one in pottery and the other in hand weaving.

Several years ago a course in ceramics was introduced into the curriculum of the Pine Ridge High School. Adults also were given opportunity to learn pottery making. Local clays and glazes were developed and a characteristic Pine Ridge glazed pottery has emerged, a pottery that is waterproof and ovenproof. The recently authorized tribal project will permit the acquisition of new equipment and the employment of a competent supervisor to organize the production, expand materially the volume, and seek additional outlets.

Hand weaving was also introduced into the Pine Ridge High School in 1937, and there are a number of good weavers on the reservation. New equipment will be obtained, a full-time manager-instructor will be employed, and a line of hand-loomed draperies and upholstery material will be produced.

The $25,000 loan will supplement the present capital of the Pine Ridge Arts and Crafts Association.

The Board will supply the management and supervision on a reimbursable basis and work in cooperation with a local management advisory committee, composed of representatives of the agency, the tribal council, and the craftsmen.

TRIBAL SELF-GOVERNMENT

Considerable progress in self-government was made during the year by Indian tribes, many of which have governing bodies as a result of incorporation under the Indian Reorganization Act of 1934, the Oklahoma Indian Welfare Act, the Alaska Act, and other legislative authorizations. The various provisions of these acts were the source of new powers and responsibilities for the Indian tribes and additional policy directions in Indian affairs administration. The inherent powers of Indian tribes were specifically recognized in the sections dealing with tribal organization and incorporation, and these powers were defined in an opinion issued in 1934 by the Solicitor of the Department of the Interior.

During the past year, the Pueblo of Laguna in New Mexico ratified a constitution by a vote of 801 for and 75 against. The Umatilla Tribe of the State of Washington likewise adopted a formal governing document by a vote of 113 for and 104 against.

The tribes located in Oklahoma not now organized under formal documents have displayed an active willingness to assume additional political and economic control over their internal affairs, and five are now engaged in drafting constitutions.

The officers of the Five Civilized Tribes have also renewed their interest in tribal affairs and in coordinating their activities under an intertribal council. This council held a meeting in February 1950 and resolved to work with the staff of the Superintendent of the Five Civilized Tribes Agency to speed advancement of tribal matters, looking toward the time when the whole of Indian administration in eastern Oklahoma can be brought to a final conclusion.

Since the autonomy of the tribal authorities has increased, some weaknesses in tribal organizations have come to light, making it necessary for some tribes to revise their charters to bring them more into harmony with their growing activities and responsibilities. The Minnesota Chippewa Tribes, for example, is revising its governmental structure to provide for a much smaller governing body. The Puyallup Tribe of the State of Washington has scheduled a tribal referendum on a proposed amendment to its constitution to extend the leasing period of tribal lands for as long a period as is permitted by law. Existing law permits the leasing of tribal lands for a period not exceeding 5 years.

Many of the tribal charters that have been issued by the Secretary of the Interior limit secretarial review to a term of years, usually 5 to 10. Many of the tribes which adopted charters since 1936 have passed the 10-year mark and are now legally able to terminate secretarial review by vote of the tribe. The Blackfeet Tribe submitted to a tribal referendum the question of terminating the Secretary's supervisory powers contained in its corporate charter. The measure was defeated.

Although much authority over Indian affairs has been delegated by the Commissioner of Indian Affairs to his area representatives, many tribes still find it necessary to send delegates to Washington to transact tribal business with the committees of Congress and the Bureau. The majority of these tribal delegates have visited Washington in order to confer with their tribal attorneys concerning prosecution of tribal claims against the United States.

THE LEGAL RECORD

SUFFRAGE

Early in the fiscal year, a Federal court removed another barrier to Indian suffrage. On August 3, 1949, a Federal court held, in the case of *Trujilla* v. *Garley*, that a provision in the New Mexico Constitution denying Indians "not taxed" the privilege of voting violated the fourteenth and fifteenth amendments of the Federal Constitution. The court granted a permanent injunction against a county official who had refused to register a member of Isleta Pueblo.

United States v. *Ahtanum Irrigation District et al.*, a case especially important to all Indian irrigation projects, was given a preliminary hearing at Yakima, Wash. This case involved the rights of the Yakima Indians of Washington in the Ahtanum Creek under a purported contract executed by the Ahtanum irrigation district and the Secretary of the Interior in 1908 which divided the water of Ahtanum Creek between Indians and non-Indians. Subsequently, a motion by the defendant to dismiss the case was denied. Government counsel are now awaiting the setting of a pretrial conference date.

In the cases of *Arenas* v. *Preston et al.*, and *United States et al.* v. *Preston et al.*, the United States Court of Appeals for the Ninth Circuit upheld the jurisdiction of the United States District Court for the Southern District of California to award fees and expenses to attorneys who had obtained, in prior litigation, allotments of land for members of the Agua Caliente or Palm Springs Band of Indians and to impress the allotments with security liens for the payment of the fees and expenses. Under these decisions, the district court may order the sale of such portion of the allotted lands as may be necessary to satisfy the claims of the attorneys. Application for writ of certiorari has been made to the Supreme Court.

United States of America v. *James Marsh* involves the rights of several Indian tribs to fish at "usual and accustomed" sites pursuant to certain treaties with the United States. Suit was instituted on June 15, 1950, on the recommendation of the Bureau of Indian Affairs. A final decision has not yet been reached.

PROSPECTIVE LEGISLATION

House bill 1537, not as yet enacted, recommends a general method of establishing State jurisdiction on reservations where such action appears desirable. Under this plan, the Secretary of the Interior, where it appeared desirable in the public interest, would be empowered to call a referendum on a reservation to determine whether or not the tribe wished to be placed under State jurisdiction. In case of an affirmative vote, this action would be taken immediately. Where the vote was negative, the tribe would be permitted 1 year in which to set up a code of Indian offenses, with adequate tribal enforcement procedures, subject to the approval of the Secretary of the Interior. If this should not be accomplished within a year following the referendum, the Secretary may by proclamation place the Indians under State jurisdiction.

The law and order problem, especially juvenile delinquency, as it affected the Klamath Reservation, necessitated the preparation of drafts of specific legislation establishing State jurisdiction over all offenses on this reservation. The bill followed the general policy outlined for House bill 1537, mentioned above.

Bills transferring criminal jurisdiction over Indian reservations in Arizona, Nebraska, and California and a bill to repeal the Federal Indian liquor law were drafted.

The Commissioner, with approval of the Secretary of the Interior, refused to recognize the so-called People's Committee of the Seneca Nation as its governing body on the ground that the constitution pursuant to which recognition was claimed was invalidly adopted. The alleged president is the plaintiff in the case of *Theodore L. Jimerson* v. *Dillon Myer et al.*, and has filed suit seeking payment of the lease rental money due under the Ryan Act of February 28, 1901 (31 Stat. 819), and to restrain payment to the officers recognized by this Bureau and the Department.

The United States Court of Claims handed down two notable decisions during the fiscal year, which would result in the awarding of some $48,000,000 to several Indian groups. On July 13, 1950, the Consolidated Ute Bands received judgments totaling $31,761,207.62. The second decision, delivered January 3, 1950, would grant the Tillamook, Coquille, Tootootoney, and Chetco Bands of Indians a total of $16,515,604.77. This case is now before the Supreme Court on certiorari.

ADMINISTRATION

Reorganization plans for the Bureau were completed during the year. Administrative functions were consolidated into a well-integrated Division of Administration, with five staff branches; functions and responsibilities of each of the branches were documented and organization plans put into operation. It is proposed, for the next fiscal year, through the use of the staff facilities in the Washington office, to improve the field organization and operations through surveys, reports, and detailed analyses of field problems by Washington and area office personnel.

Management Improvement Plan

The Bureau, in accordance with the directives of the Bureau of the Budget and the Secretary, has prepared a management-improvement plan. This plan sets forth the major objectives of the management improvement in the Bureau with a general outline of the methods for accomplishing these objectives and enumerates some of the most important opportunities for improvement. The following phases of the management-improvement program are expected to be completed within the next fiscal year: (1) development of policy objectives; (2) field organization plans; and (3) manuals of operation.

Property and Supply

Program.—As a part of the reorganization of the Bureau, all property-management functions were consolidated into one organization. Functions and delegations of authorities were outlined and defined with definite responsibilities assigned to the Branch of Property and Supply for a coordinated property-management program. The property-management organization comprises procurement, storage and issue, traffic management, specifications, inspection, property identification, property utilization, and disposal functions. In addition to these specific activities, the Branch has been assigned responsibility for the management of records, the Bureau's safety program, and office services functions.

Procurement.—Heretofore, the Bureau maintained a combined purchasing and staff advisory service in the Chicago Procurement Office. The Chicago office was disbanded and personnel transferred to Washington headquarters, with activities assigned to employees on a staff basis. In collaboration with the General Services Administration and the Munitions Board Cataloging Agency, the staff is now engaged in the preparation and development of procurement specifications. An Indian service catalog for the field in conducting the Bureau's supply functions is in preparation.

Negotiations with officials of the General Services Administration were completed during the year, in conformance with the provisions of the Property and Accounting Act of 1949, Public Law 152, Eighty-first Congress. Under this act, the Federal Supply Service will perform the major portion of the actual operating purchasing functions. Results to date indicate that the new purchasing program will produce increased efficiencies and future economies.

Surplus food-commodity disposal program.—Under the provisions of section 416 of the Agricultural Act of 1949, Public Law 429, Eighty-first Congress, surplus food commodities were made available to the Bureau and considerable quantities of urgently needed food items were and will continue to be distributed to needy Indians.

Budget and Finance

In order to bring about closer coordination and control of financial affairs of the Bureau, the functions formerly exercised by the budget and the fiscal divisions were consolidated under one head in the Branch of Budget and Finance.

Progress was made in the development and installation of procedures that should accomplish major improvements in budget matters. These procedures provide for effective participation of field jurisdiction in the determination of budget making; establishment of workload standards to support justifications and to govern allocation of available funds on the basis of current requirements, financial control of program operations, and progress reports.

With establishment of area offices, there was developed a system of accounts that will operate on a decentralized basis to better meet requirements of Bureau management.

Buildings and Utilities

Dedication of two dormitories at the new Shiprock Boarding School in January marked a tangible step in the Navajo long-range program. Construction of additional dormitories begun during the fiscal year and award of a contract for the central heating plant at Shiprock, for which bids were requested in June, will further this development. Construction is also under way for two new classroom buildings, an auditorium and a gymnasium at the Intermountain Indian School.

Plans were also begun during the fiscal year for construction of a new 400-pupil boarding school on the Navajo Reservation. This school will be constructed at Kayenta, an isolated community in the northwest corner of the reservation approximately 160 miles from railhead.

A tendency for communities with a large Indian population to request Federal funds to assist in the construction of schools was again noted during this fiscal year. Funds totaling $1,294,000 have been obligated for the construction or improvement of 11 schools of this type during fiscal year 1950. All but one of these school projects are designed by private architects employed by local school boards and are being constructed under contracts executed by the local school authorities.

The Bureau has, during the year, placed considerable emphasis on bringing the physical plant into better operating conditions after many years of enforced neglect because of wartime restrictions and shortages of materials. Major repair projects amounting approximately $400,-

000 were initiated during the year and largely completed. These projects included modernization of schools, hospitals, residences, reduction of fire hazards in old dormitory buildings.

The Bureau faces a maintenance problem greater than that of most Government agencies because of the many old Army post buildings taken over by the Bureau after the Indian wars of the nineteenth century used to this day. The Congress has shown a sympathetic understanding of the problem and the Bureau contemplates continued appropriations to permit a gradual reduction of the more serious cases of neglect.

PERSONNEL

Although restricted by personnel limitations, the Bureau personnel staff has worked to increase the effectiveness of the Bureau program. Personnel administration is a direct responsibility of operating management. To that end staffs of the Washington and area offices devoted themselves to assisting operating officials in solving varied personnel problems. Training programs were conducted for agency employees, and this was followed by inspections of work being performed in order to comply with civil-service rules and regulations.

Emphasis was placed upon evaluation of existing allocations and development of a classification program. A classification survey of all Washington office positions was completed and a comprehensive resurvey of all field positions is well under way which, when completed, will enable the Bureau to standardize the conduct of this important responsibility of personnel management.

The Bureau established a committee of expert examiners, with the approval of the Civil Service Commission, to accelerate the recruitment of nurses and doctors.

Probably the most significant step undertaken by the Bureau, from a personnel standpoint, was establishment of the Department wage board procedure throughout the Bureau. This will bring about the payment of prevailing hourly rates of pay to all construction and operation and maintenance personnel and regularize their functions. This will complete the long-range program of the Bureau in stabilizing the employment of Indians throughout the Bureau and insuring equality of pay in all lines of work.

Office of the Solicitor

Mastin G. White, *Solicitor*

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GENERAL.—The volume of important legal work requiring attention at the departmental level continued to be disproportionate to the personnel strength of the Solicitor's Office, which has operated with a depleted staff for the past 3 years. As a result, there was a further increase during the fiscal year 1950 in the backlog of work on hand and awaiting disposition in the Office of the Solicitor. Whereas there were 484 items of work on hand and awaiting attention at the beginning of the fiscal year, the number of items on hand and awaiting attention at the end of the fiscal year aggregated 586. This loss of ground in our effort to maintain the legal work at the departmental level on a reasonably current basis occurred despite the fact that 12,901 items of work were disposed of by the Solicitor's Office during the fiscal year 1950.

OPINIONS.—The following summaries of some of the formal opinions rendered during the fiscal year will indicate the types of legal questions considered by the Office of the Solicitor:

M–36000: Members of the Nez Perce Tribe of Indians who were not granted trust patents to allotted lands prior to May 8, 1906, and who have not received fee patents to such allotments at any time, may engage in hunting, fishing, and trapping on tribal lands or trust allotments within the exterior boundaries of the Nez Perce Indian Reservation in Idaho without observing the provisions of the State conservation laws.

M–36003: The authority of the Secretary of the Interior under the act of May 14, 1948, to issue patents in fee, to remove restrictions against alienation, and to approve conveyances extends to all restricted or trust lands held by individual Indians who are members of tribes that brought themselves within the coverage of the Indian Reorganization Act.

M–36007: An Indian tribe which is organized and incorporated under the Indian Reorganization Act can issue oil and gas leases on tribal lands without competitive bidding if, and only if, the charter of the tribe expressly provides for such leasing on a noncompetitive basis.

M–36009: The Southwestern Power Administration is authorized (*a*) to rent transmission facilities and (*b*) to purchase electric power for the purpose of firming up the hydroelectric power distributed by the Administration from Army projects.

M–36012: The coastal waters contiguous to privately owned tracts of land situated within the exterior boundaries of the Karluk Indian Reservation in Alaska constitute part of the reservation.

M–36017: A regulation which requires purchasers of Indian timber to grant to Indians a preference in employment does not prevent a purchaser of such timber, who is operating under a union-shop agreement with a labor union which admits Indians to membership, from requiring Indian employees, as a condition of continuing in his employment, to join such labor union and to maintain their membership in the union.

M–36018: The Secretary of the Interior may delegate to the Assistant to the Secretary powers which involve the exercise of discretion.

M–36020: The function of coordinating the activities of the various executive departments and independent establishments of the Government with respect to petroleum, which the President delegated to the Secretary of the Interior in 1946, was not transferred, in whole or in part, to the National Security Resources Board as a result of the enactment of the National Security Act of 1947.

M–36023: The Department cannot properly set off a sum still owing to a former employee, and covering salary earned and travel expenses incurred while in the employ of the Department, against an amount which the Department has paid to a third person in settlement of a tort claim arising out of the negligent conduct of the former employee during the period of his employment with the Department.

M–36024: The President has implied power, in the absence of statutory authorization, to permit the extraction and use by Federal agencies, for governmental purposes, of gravel from lands underlying navigable inland waters in the Territory of Alaska.

M–36031: Under section 39 of the Mineral Leasing Act, the term of a mineral lease is extended by any period of suspension of operations and production that may have been in effect under section 39 during the life of the lease, irrespective of whether such suspension occurred during the original term fixed for the lease or during the extended term resulting from a prior suspension of operations and production.

Appeals.—The Office of the Solicitor continued during the fiscal year 1950 to render final decisions, under delegations of authority from the Secretary of the Interior, upon formal appeals to the head of the Department from the decisions of bureau officials in public-land proceedings, in Indian probate proceedings, and in disputes arising under contracts between agencies of the Department and private contractors. Some of the more important decisions rendered in these various fields are summarized below:

United States v. *Margherita Logomarcini* (A–25448).—An application for a mineral patent will be rejected where, although the claim may formerly have been valuable for minerals, it is not shown as a present fact that the land is mineral in character and is valuable for its mineral content.

Ohio Oil Company and M. D. Woolery v. *W. F. Kissinger and Yale Oil Corporation* (A–25537).—Mining claimants who protest against the issuance of an oil and gas lease on land covered by their claim have the burden of proving that the claim is valid. This burden is not met in a case where the evidence shows that, prior to the discovery of a mineral deposit, the area of the claim was included in a withdrawal order; that the claimants had only piled some lumber on the claim and started the construction of a derrick at the time of the withdrawal; and that thereafter, over a period of more than 2 years, their only activities on the claim consisted in the erection of two incomplete derricks, occasional work on roads, the excavation of a sump, and the performance of intermittent work on the grading and leveling of sites for equipment.

Sydney B. Moeur et al. (A–25548, A–25570).—A State does not, by filing an application to aquire a tract of public land by means of an exchange under section 8 (c) of the Taylor Grazing Act, automatically acquire a vested right in the tract.

Pacific Gas and Electric Company (A–25585).—An applicant for a right-of-way for the construction of an electric transmission line across public land within a proposed reservoir area may be required to stipulate that, if the Government should subsequently need the right-of-way for the construction and operation of a Government-owned electric transmission line, the applicant will relocate its line without cost to, or liability on the part of, the Government.

Alzada C. Carlisle and Parkhill Montana Ranches, Inc. (A–25671).—A person who, as a joint tenant, owns an interest in land that is contiguous to an isolated tract of public land that has been offered for sale has a preferential right to purchase such tract.

Hugo Giomi (A–25672).—Where compensatory royalty was charged against the holder of an oil and gas lease on Government land because of the supposed drainage of oil or gas from such land by a producing well on adjoining land, and the lessee paid the compensatory royalty, such land must necessarily be regarded as within the known geological structure of a producing oil or gas field, even though there has been no formal determination made to that effect.

Charles H. Hunter (A–25707).—A preference-right claim to purchase an isolated tract of public land offered for sale may be asserted by a person who acquires the ownership of contiguous land after the date fixed for the sale but during the period of time allowed for the assertion of preference-right claims.

Florence E. Gallivan et al. (A–25815).—The Mineral Leasing Act of 1920 has no application to the lands which were ceded to the United States by an Indian tribe for disposition under an agreement whereby the proceeds derived from such disposition are to be utilized for the use and benefit of the Indians, and which have not been disposed of by the United States or restored to tribal ownership.

Roy L. Bair & Company and James Crick & Sons (CA–54).—The terms "laborers" and "mechanics," as used in a so-called escalator clause providing for an adjustment in the amount to be paid to the contractor under a Government contract in the event of changes in the wage rates of laborers and mechanics, do not include working foremen.

George Pollock Co. (CA–66).—A claim for extra compensation under a contract for the construction of an electric power transmission line, based on the failure of the Government to provide rights-of-way as needed for continuous construction, constitutes a claim for unliquidated damages and cannot be considered by an administrative official of the Government.

J. A. Terteling & Sons, Inc. (CA–69).—A claim for additional compensation under a contract with the Department, based upon alleged increases in the costs of performance occasioned by a stoppage of the work due to the apparent imminence of an exhaustion of the funds used to finance operations under the contract, is a claim for unliquidated damages and cannot be considered by an administrative official of the Government.

Estate of George Bird Eagle (IA–13).—Even though an Indian couple went through both civil and religious ceremonies in getting married, they can be divorced in accordance with Indian custom and without any decree of divorce being entered by a court. A divorce in accordance with Indian custom may be effected unilaterally by one party separating from the other with the intention that the separation shall be permanent.

Estate of Mer-dah-ke (Herbert Homovich) (IA–14).—The law of the State of Oklahoma on the revocation of wills has no application to the will of a Comanche Indian devising restricted or trust property, even though the Indian was domiciled in Oklahoma and the property is situated in that State.

Estate of Ke to sah Jefferson (IA–19).—An Indian may dispose of restricted property by will without regard to any limitations imposed by State law on the making of wills.

Allotment of Lands on the Agua Caliente or Palm Springs Indian Reservation in California (IA–21).—The right to an allotment of land on an Indian reservation does not give to an individual member of the tribe or band an interest in any specific property until such time as the right is identified, through the allotment process, with a particular tract of land. Other things being equal, priority of selection, and not priority of birth, determines the right to an allotment of a specific tract of land which is covered by conflicting selections.

LITIGATION.—Several decisions of importance to this Department were rendered by the Supreme Court during the past fiscal year.

In the case of *Oscar L. Chapman* v. *Sheridan-Wyoming Coal Company, Inc.*, the Supreme Court upheld this Department's administrative determination to issue a coal lease on certain public land in Wyoming to the Big Horn Coal Co. over the objection of that company's competitor, the Sheridan-Wyoming Coal Co., Inc. The Court held that a regulation of the Department, providing that the General Land Office (now the Bureau of Land Management) should make a favorable recommendation to the Secretary respecting the issuance of a new coal lease only in a situation where a showing had been made that additional coal land was needed to supply the demand for coal in the particular area, did not confer upon the holder of an existing lease any right to prevent the Secretary from issuing a new coal lease to a competitor, even in a situation where the showing of need contemplated by the regulation had not been made.

The Supreme Court held in the cases of *United States* v. *Louisiana* and *United States* v. *Texas* that the United States, and not the respective States, has paramount rights in, dominion over, and ownership of the submerged coastal lands, including their oil and gas deposits, adjacent to the shores of Louisiana and Texas.

In the case of *United States* v. *Gerlach Livestock Company*, the Supreme Court upheld the power of Congress to authorize the construction of reclamation and irrigation projects under the general welfare clause of the Constitution. The Court also held that, under the Reclamation Act of 1902, the claims of riparian owners for damages based on the diminution of the flow of a river caused by the construction upstream of a dam and related irrigation system are governed by the provisions of State law.

Upon the recommendation of this Department, the Attorney General applied to the Supreme Court for writs of certiorari in the cases of *Arenas* v. *Preston et al.* and *United States et al.* v. *Preston et al.* The United States Court of Appeals for the Ninth Circuit held in these cases that the United States District Court for the Southern District of California, in awarding fees and expenses to attorneys who had obtained in prior litigation allotments of land for members of the Agua Caliente or Palm Springs Band of Indians, had the power to impress the allotments with liens as security for the payment of the fees and expenses.

Tort Claims.—The office disposed of 108 tort claims (including 12 cases in which appeals had been taken from decisions rendered by field attorneys of the Department) during the fiscal year 1950 under a delegation of authority from the Secretary.

Legislation.—Some of the statutes of major importance to the Department of the Interior that were enacted by the Eighty-first Congress during the fiscal year 1950 are indicated below:

Public Law 226, declaring that the United States holds certain lands in trust for the Pueblo Indians and the Canoncito Navajo group in New Mexico.

Public Law 264, the Alaska Public Works Act.

Public Law 275, authorizing the sale of public lands in Alaska.

Public Law 335, providing for the return of rehabilitation and betterment costs of Federal reclamation projects.

Public Law 356, authorizing the American River basin development in California for irrigation and reclamation purposes.

Public Law 408, an act designed to further the policy enunciated in the Historic Sites Act, to facilitate public participation in the preservation of sites, buildings, and objects of national significance or interest, and to provide for a national trust fund in this field.

Public Law 437, vesting title to certain lands of the Three Affiliated Tribes of the Fort Berthold Reservation, N. Dak., in the United States, and providing for the payment of compensation to the Indians.

Public Law 463, authorizing the Secretary of the Interior to acquire, construct, operate, and maintain public airports in, or in close proximity to, national parks, monuments, and recreation areas.

Public Law 469, authorizing the disposal of withdrawn public tracts that are too small to be classed as farm units under the Reclamation Act.

Public Law 474, an act to promote the rehabilitation of the Navajo and Hopi Tribes of Indians and the better utilization of the resources of the Navajo and Hopi Indian Reservations.

Public Law 490, revising or repealing certain statutes relating to rules of survey, and permitting departures from the system of rectangular survey on public lands when necessary.

Public Law 493, requiring settlers on public lands in Alaska to record notices of their settlement claims in the land office for the district in which the lands are situated.

Public Law 553, extending to the Midway Islands, Wake Island, Johnston Island, Sand Island, Kingman Reef, Kure Island, Baker Island, Howland Island, Jarvis Island, Canton Island, and Enderbury Island the laws of the United States relating to civil acts or offenses consummated or committed on the high seas aboard vessels belonging to the United States.

Division of Territories and Island Possessions

James P. Davis, *Director*

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NEARLY 3,000,000 PEOPLE OF MANY RACES, in the Caribbean, the islands of the Pacific, and in Alaska, look to the Office of Territories[1] as their representative, their counselor, and their friend. These Territorial peoples, who are United States citizens, are in different stages of political and economic development. It is the prime duty of the Office to encourage that development along a pathway that leads to full partnership in the rights and duties of citizenship in a federation of self-governing states. In a political sense successful performance of the duties of the Office can be measured by the degree to which the responsibilities which it is given are transferred to the lands and the peoples for whom it is the Federal sponsor.

The Office of Territories is first of all the eyes and ears of Congress and the President in watching over and reporting upon Territorial advancement. It is a planning agency which seeks to further that advancement through wise legislation, through action of the Governors, and through sympathetic assistance to other Federal agencies with duties in the Territorial field. The Office acts as the representative in Washington of the Governors and the citizens of the Territories. It participates in foreign policy matters which are of concern to them. Finally it has operating responsibilities in promoting the economic growth of the Territories through supervision of the activities of the Alaska Road Commission, the Alaska Railroad, the Puerto Rico Reconstruction Administration, the Virgin Islands Corporation, and the public-works programs of Alaska and the Virgin Islands.

The reports that follow describe the progress of the Territories during the past year. Many agencies, including this Office, have contributed to that progress. But the major reliance of all friends of the Territories in the growth of self-government and social and economic wel-being continues to be placed on the courage, the initiative and the resourcefulness of Territorial citizens.

No matter how healthy the rate of political and economic growth it is always true that much remains to be done. Particularly in matters economic the stubborn facts of resources and organization present a perpetual challenge. It is the peculiar virtue of the American combination of political democracy and economic adventurism that few men are satisfied to remain in the economic groove to which time and circumstance seem to have allotted them. The United States can and must provide the opportunity for the fulfillment of this desire for progress in the Territories as well as elsewhere. And this must be done not only where the problems faced are easy but where they are both complex and difficult.

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[1] As of July 28, 1950, the Division of Territories and Island Possessions became the Office of Territories, and the Regional, Legal, and Administrative Branches became Divisions of the Office.

The Territories, taken all in all, are rich both in manpower and resources. But they are not equally so and some have problems sufficiently serious as to discourage those who lack faith in American institutions. The Office of Territories has watched and has been a part of an astounding growth in Territorial democracy during the last few years. This coming of age has brought Hawaii and Alaska to the verge of statehood, and is providing Puerto Rico with self-government under a constitution of its own choosing. It has meant Territorial status for Guam and will bring similar political advantages to American Samoa and the trust territory. Among the many virtues of political liberty is the stimulus it gives to economic enterprise. The political advance has been swift. This Office pledges itself to do all within its power during the next decade to insure that the economic development of the Territories does not lag behind.

ALASKA

The great land mass of Alaska with its extensive resources, its varied climate, and its sparse population have given rise to political and economic problems that are unique among the Territories. In this area the Office of Territories plays its major operating role through its supervision over The Alaska Railroad, the Alaska Road Commission, and the Alaska public-works program. Other bureaus and offices of the Interior Department, and other Government agencies, also have a large part in Alaskan development, not only because of Alaska's military importance, but because most of the land is still in the joint possession of all the people of the United States.

The dominance of Federal interests in Alaska has been pointed to as a threat to the growth of an independent and self-reliant citizenry. The facts of Alaskan life belie this suggestion. Alaskans are no doubt more dependent upon great cooperative enterprises than most other groups of Americans. At the same time they are intensely individualistic and are eager to assume their proper role as the geographically greatest of all the States. The major events of the year for Alaska centered around the actions taken to achieve this goal.

Progress Toward Statehood

Enabling legislation for Alaskan Statehood (H. R. 331) came close to enactment during the last fiscal year. The bill which had been reported favorably by the House Committee on Public Lands in the first session of the Eighty-first Congress was passed by the House on March 3, 1950. After extensive hearings before the Senate Committee on Interior and Insular Affairs during the last week in April, the bill with amendments was reported favorably by that committee. The Secretary of the Interior, an Assistant Secretary of State, high military officials, the Governor of Alaska, and many Alaskans testified before the committee. Much credit for the Territory's progress toward statehood is due to the untiring attention and effort given by these two committees of the Congress.

At the end of the fiscal year there was every prospect that, if the bill could be brought to the floor of the Senate, statehood for Alaska would be at last a reality.

Public Works Program

Among the most important items of legislation affecting Alaska which Congress acted on during the year was Public Law 264, approved August 24, 1949, authorizing a $70,000,000 public-works program for the Territory. Under this program the Federal Government will provide grants ranging between 25 and 75 percent of the cost of essential community facilities (schools, water, sewer systems, etc.) sponsored by the Territory, incorporated municipalities, or other local public bodies. The act provides that the total Federal contribution will not exceed 50 percent of the authorized program. Upon completion by the Federal Government, the sponsoring agencies will take over, operate, and maintain the facilities. This act is an essential supplement to the Alaska Housing Act which became law in fiscal year 1949.

Under the President's Reorganization Plan No. 15, the Alaska public-works program was transferred from the General Services Administration to the Department of the Interior, effective May 24, 1950. Supervision of the program has been given to the Office of Territories. The appropriation for the 1950 fiscal year provided $1,000,000 in cash and $4,000,000 in contract authority to finance the first year's program. A total of 99 applications had been received from Alaskan communities at the end of the fiscal year, of which 18 had been approved. Bids on two projects were opened in May and June and others are in process for early advertisement.

Housing

The housing program in Alaska was also advanced by the appropriation of $10,000,000 to the Housing and Home Finance Administration to be made available to the Alaska Housing Authority as a revolving fund to carry out the provisions of the Alaska Housing Act.

Public Lands

The Alaska Land Sales Act, Public Law 275, approved August 30, 1949, is another important measure in Alaska's development program. Under the terms of this act, the Secretary of the Interior may sell land which he has classified as suitable for industrial or commercial purposes. Sale will be by public auction and the tracts may not exceed 160 acres. This new law supplements other legislation for the disposal of public lands and will aid greatly in increasing their usefulness to Alaska's expanding economy.

The Alaska Road Commission and the Road Building Program

The Alaska road program made excellent progress during the year, even though construction was impeded during the 1949 building season by unfavorable weather in some areas. Paving was practically completed on the Glenn Highway between Anchorage and Palmer, on a 44-mile section of the Richardson Highway south of Fairbanks, and on a similar section of the Alaska Highway. Paving was well advanced on a further 54-mile section of the Glenn Highway east of Palmer and on the remaining 53-mile section of the Richardson Highway between Fairbanks and the junction of the Alaska Highway at Big Delta.

The Richardson Highway was kept open to traffic through Thompson Pass north of Valdez for the first time in history during the winter of 1949–50, making possible through highway traffic to interior points from the port of Valdez. Substantial truck traffic moved over this route throughout the year.

The 130-mile highway extending from the boundary of the Chugach National Forest to the west side of Kenai Peninsula and to the agricultural district near Homer was formally designated the Sterling Highway and opened to through traffic. This highway will be an important factor in making accessible the better agricultural lands of the Kenai Peninsula.

The new highway extending from the Alaska Highway to Eagle on the Yukon River was opened into the Forty Mile mining district, a total distance of approximately 80 miles. An additional 80 miles of road remains to be constructed or reconstructed before this project is completed. Construction was started before the end of the year on the lateral highway to extend from the Richardson Highway into Mount McKinley National Park.

Work on the Turnagain Arm Highway connecting the Kenai Peninsula with the central road system was nearly three-fourths complete. A substantial survey program was carried forward in advance of construction on several other routes which are included in the highway plan. The local farm road program was advanced materially during the year with a total of 57 miles of new roads graded and approximately 80 miles surfaced, largely in the Anchorage, Palmer, and Fairbanks areas.

Definite steps were taken toward providing control of highway loads during the spring thaw and breakup period, especially in the areas of newly paved highway. The plan for control provides that all truck loads will be prohibited at the first of the breakup period with light loads subsequently permitted as the load-bearing capacity of the pavement is determined. Actual traffic control is being handled by Alaska Road Commission personnel.

The Alaska Railroad Looks Ahead

Fiscal 1950 marks the third year of The Alaska Railroad's rehabilitation program, designed to bring the line up to first-class operating conditions. During the year, bank widening and track re-lay were carried out along substantial portions of the main line. Additions were made to rolling stock, thus increasing the efficiency of service and operations. The teletype communications portion of the program was about 80 percent accomplished at the end of fiscal 1950. Rehabilitation has already greatly increased the speed and facility with which the Railroad handles its traffic load. By the end of the next construction period the transformation of this lifeline to the interior will be substantially complete.

For fiscal year 1950, operating revenues totaled $11,296,371.80, as compared to $10,836,649.10 in 1949. On April 15, 1950, a 15-percent rate reduction became effective on carload lots of drugs, paper goods, and insulating materials. An earlier rate adjustment made possible the bulk distribution of cement.

Effective July 21, 1949, the provisions of the Civil Service Retirement Act were extended to the employees of The Alaska Railroad in place of the 13-year-old Alaska Railroad Retirement Act. The Civil Service Act makes available many retirement benefits accruing to classified Federal employees, including provision for annuities to widows and children.

In August 1949, ground was broken for the permanent Government Hill housing project at Anchorage. This project, being built under The Alaska Railroad's auspices, will cost an estimated $12,000,000 and will contain 682 units. It is Alaska's largest housing development. Plans were also drawn up for projects to be built at Whittier, Curry, Healy, and Fairbanks.

An agreement for the joint construction of a power plant at Anchorage by The Alaska Railroad and the Chugach Electric Association was concluded during the year. Construction contracts were let after the CEA had received a Rural Electrification Administration loan.

River-boat operation by the Railroad from Nenana on the Tanana River to Fort Yukon and Marshall on the Yukon ceased in October. Passenger service has been discontinued except for local point-to-point service which, with the lapse of the mail contract, has allowed the boats to be operated on irregular freight schedules at reduced operating costs.

Expanding Air Transport

A greatly needed airport construction program is being accomplished under the Federal-aid airport program (Public Law 377, 79th Cong., as amended). In order to expedite this program, an Interdepartmental Airport Committee was established, composed of representatives from the Civil Aeronautics Administration, National Park Service, Bureau of Land Management, Fish and Wildlife Service, The Alaska Railroad, and the Office of Territories. Construction has started on four airports—Dillingham, Kotzebue, Ninilchik, and Fort Yukon. Many coastline towns and island settlements require seaplane facilities and several applications for such facilities have been received.

Aids to Agriculture

An outstanding contribution to the agricultural development of Alaska was provided by the enactment of a bill making it possible for the Farmers' Home Administration to make loans for the development of farms on homestead lands before, instead of after, the settler acquires his patent from the Government.

Approval of Public Law 417, October 7, 1949, extended to the Territory full coverage of the provisions of Agricultural Extension Service acts. Future requests for funds will be computed on the same basis as appropriations to the States. This act provides for salaries of "county agents" for Alaska's four judicial divisions. Under previous law Alaska had been less favorably treated than the States.

On July 1, 1949, there was returned to the University of Alaska rom the Department of Agriculture the administration and operaion of the Agricultural Experiment Farms in the Tanana and Matauska Valleys and at Petersburg. The transfer will permit the uniersity to expand its service to Alaskan farmers through programs or diversifying and improving Alaskan agriculture.

TERRITORIAL TAXATION

During the year, the Territory enacted its first income tax act, which levies a tax on personal and corporate income equivalent to 10 percent of the Federal tax. The act, promptly challenged by the Alaska Steamship Company, was upheld by the District Court in Alaska, with judgment affirmed by the United States Court of Appeals for the Ninth Judicial Circuit. Because of the importance of the tax law to the Territory, the United States took part in the litigation as *amicus curiae*.

Alaskans were granted a greater degree of control over tax revenues when the President approved a bill divorcing the Federal Government from the field of business license taxation in Alaska (Public Law 300). Business license taxes were established by Congress in 1899 with the revenue collected going to the "Alaska fund" in the Federal Treasury. Disbursements from this fund have been made to the Territory for public schools, relief of the indigent, and for roads, but only after specific congressional approval. At its 1949 session the Territorial Legislature established a comprehensive business license tax schedule to be in force on the January 1st following repeal of the 1899 Federal law. Revenue from business license taxes will now go directly into the Territorial Treasury.

TOWARD A MENTAL HEALTH PROGRAM

During the year a study was made of the mental health problem in Alaska, including the possible need to build a complete psychiatric hospital in the Territory. At present the mentally ill are cared for at a hospital in the States under a cooperative arrangement between the hospital and the Federal Government. The results of the field study and the recommendations submitted will be used as the basis for any necessary legislative action.

PLANNING FOR THE PACIFIC NORTHWEST

The development of the Northwestern Pacific area requires integrated planning and the closest cooperation between the United States and Canadian Governments, as well as between Government and industry. To further this national and international interest, the Northwest Development Committee was formed of members of the Chambers of Commerce of Canada and the United States and representatives of private industry. This committee will study the problems of over-all development, including transportation, natural resources, and the establishment of industries.

PUERTO RICO

The Puerto Rico Constitution

The fiscal year 1950 was one of notable progress for Puerto Rico. The most significant advance in self-government since 1947, when an elected Governor was authorized, was made on June 30, 1950, when the constitution bill was passed by the House, having previously been passed by the Senate. It was approved by the President as Public Law 600, Eighty-first Congress, on July 3, 1950. The new law, which is subject to acceptance by the people of Puerto Rico, authorized the convening of a constitutional convention and the drafting of a constitution establishing a republican form of government and containing a bill of rights. Upon ratification of the constitution, and approval by the President and the Congress, it will become effective and those provisions of Puerto Rico's present organic act which deal with internal matters, such as the composition of the legislature, qualifications for voters, etc., will be repealed and the corresponding provisions of the new constitution will be applicable. Puerto Rico's political and economic relationship to the United States will remain the same, but the local government will operate in accordance with provisions of law adopted by the people of Puerto Rico, instead of by the Congress. The constitution act had the hearty support of the President, the Departments of Interior and State, the Governor of Puerto Rico, the Puerto Rican Senate and House of Representatives, and the Resident Commissioner for Puerto Rico. It is a foregone conclusion that it will be accepted by the people of Puerto Rico. Its enactment represents a noteworthy example of democracy in practice.

Judicial Advance

Puerto Rico's judicial system has long been linked with that of the United States. Appeals from the Supreme Court of Puerto Rico are heard by the United States Court of Appeals for the First Judicial Circuit, as are appeals from the United States District Court for the District of Puerto Rico. But the appeals have always been argued in Boston. In 1950, for the first time, the Court of Appeals held a term in San Juan. Many Puerto Rican lawyers took advantage of the opportunity to be admitted to practice before the court. An order was issued in the summer of 1950 for another term to be held in San Juan in February 1951, and this may be expected to become a regular practice. It will permit many litigants who cannot afford the expense of a trip to Boston to present their cases to the Court of Appeals.

Industrial Expansion

The Puerto Rican government's program of industrial expansion showed gratifying progress. In its 7 years of existence, about 60 new industries providing about 8,000 new job opportunities have started operations in the island. All of these are producing articles not previously manufactured in Puerto Rico and represent a wide range of products such as textiles, ceramics, glass containers, shoes, blankets, artificial flowers, fishing tackle, radios, chinaware, refrigerators, hard candies, women's wear and accessories, and sun glasses. Through its tax-concession program and other forms of assistance, the Puerto Rico Industrial Development Company, an agency of the government of Puerto Rico, is assisting in attacking the serious problem occasioned by the fact that agriculture alone cannot provide an acceptable standard of living for two and a quarter million people on 3,500 square miles of land. The Puerto Rican government is seeking a share of the expansion in United States industry and does not grant tax concessions to industries which would move their plants from the mainland. The industrialization of an agricultural economy is a long and difficult process, but the record of Puerto Rico thus far is an impressive and encouraging one.

The opening of the new $7,200,000 Caribe-Hilton Hotel in San Juan which was constructed by the Insular Government and leased to the Hilton Hotel Corporation attracted considerable national publicity and resulted in a substantial increase in the tourist industry. The stimulus and assistance of the government aided in a marked increase of additional tourist accommodations, facilities, and attractions.

Air Service Needed

Puerto Rico's needs for additional air service still have not been met. Travel between Puerto Rico and the mainland must be by either water transportation or by air. Because of Puerto Rico's offshore location the inexpensive mainland methods of travel by rail, bus, or car are not available. It is therefore vital that ample low-cost service be provided by air. The Department has assisted the government of Puerto Rico in presenting its needs to the appropriate regulatory authorities, and it is hoped that the coming year will see improvement in this situation.

Unemployment Still a Problem

Results of the 1950 census indicated a total of 2,205,398 persons residing in Puerto Rico. This represents an increase of 13 percent over 1940 and increases the population density to 645 per square mile. Most heavily concentrated areas of population were San Juan, Rio Piedras, and Ponce. Unemployment during the fiscal year 1949–50 reached a peak of 131,000 in January out of a total labor force of 756,000. As the cane-harvesting season progressed in February, the number of unemployed began its seasonal decline.

Considerable numbers of Puerto Rican workers came to the United States during the year for farm work and, to a lesser extent, for employment in industry. Generally this movement has been beneficial in supplying needed workers on the continent of the United States and in alleviating the seasonal unemployment situation in Puerto Rico. The Insular Government took an active part in insuring that workers would go to areas providing the maximum employment opportunities and would enjoy working conditions equitable both to employer and employee.

Agricultural Production and Processing

Sugar, as in past years, occupied the dominant role in the island's economy. The 1950 yield is estimated to be close to 1,230,000 tons as compared with last year's record 1,274,000 ton crop. This is 320,000 in excess of the 910,000 ton quota given Puerto Rico under the Sugar Act of 1948. Last year's surplus tonnage was purchased with the assistance of the Department of Agriculture for disposition abroad. It is hoped that similar arrangements may be made for the disposal of this year's surplus.

Pineapple culture appears to be an important possibility in the insular government's agricultural diversification program. Extensive experimental work has been carried on by the Puerto Rico Agricultural Development Company. With the cooperation of the Department of Agriculture, marked improvement was brought about in the canning facilities presently on the island, and Federal grading and inspection was started. Plans are under way for the development of a cooperative plant in which most of the growers will participate. There has also been considerable interest on the part of mainland concerns in the pineapple development on the island. Four thousand acres of pineapple were cultivated, yielding 43,000 tons, an increase of approximately 800 acres and 5,000 tons over last year.

Health and Education

The insular government continued its attack on health and education problems by appropriating almost 45 percent of its $91,000,000 budget for health and educational activities.

Puerto Rico Reconstruction Administration

Operations of the Puerto Rico Reconstruction Administration during the fiscal year were financed with allotments out of the Puerto Rico revolving fund for projects approved by the President as follows:

Operation and maintenance of housing projects	$256, 532
Management and operation of federally owned lands at Lafayette	7, 131
Operation of Castaner Farm project	55, 205
Servicing of loans to cooperatives	10, 026
General administration	242, 162
Repairs and replacements, construction of farmers' houses and latrines	173, 444
Total	744, 500

Receipts from the Housing Units and sale of lots at the Eleanor Roosevelt and Morel Campos developments amounted to $472,904.79, and exceeded maintenance and operation expense by approximately $216,000. As of June 30, 270 urban and 5,492 rural month-to-month rental agreements had been converted into long-term leases with option to purchase, 1,054 units had been conveyed and title vested in urban and rural tenants, while under the liquidation program 4,072 urban and rural units were sold under the deed-mortgage plan during the year.

As in previous years, but on a greatly reduced basis, assistance was given needy resettlers in the raising, harvesting and marketing of subsistence crops. Continued efforts were also made to provide improved housing facilities for a number of underprivileged families. Meanwhile, essential projects for the fiscal year 1951 are being continued with an allotment of $826,300 out of the revolving fund. The net available balance in the revolving fund on June 30, 1950, was $2,913,211.

VIRGIN ISLANDS

Political Achievement

Another forward step in the process of self-government was made on March 24, 1950, when Morris F. de Castro, a native son of the islands, was inaugurated as Governor. This follows a pattern established when the President appointed a native of Puerto Rico as Governor of that island in 1946.

SOCIAL AND ECONOMIC PROGRESS

While the Virgin Islands still have serious social and economic problems ahead of them, considerable progress was made during the year on all fronts. During the year Congress extended to the Virgin Islands the benefits of the Vocational Education Act of 1946. This will permit a much-needed type of activity that has heretofore been lacking in the educational system of the islands. In addition, the Virgin Islands may now also participate in the Federal airport program and the national housing and slum-clearance program.

The tourist industry, which holds great promise for the improvement of the economic stability of the islands, expanded considerably during the year. Two new hotels are under construction and will be completed for the coming tourist season. A considerable number of smaller guest houses and shops catering to the tourist trade opened during the year. The progress made thus far indicates an important and expanding tourist trade.

POWER NEEDS

The electric power facilities in the islands are still completely inadequate to take care of the present needs, let alone any future expansion. The Department assisted in attempts to improve this condition, but the problem has not yet been solved. Efforts will be continued during the coming year to provide power facilities without which the islands' economic progress may be seriously handicapped.

PUBLIC WORKS

Supervision of the Virgin Islands Public Works program, Public Law 510, Seventy-eighth Congress, was transferred to the Department of the Interior and assigned to the Office of Territories toward the end of the fiscal year. Contracts have since been let for a sea wall and water-front improvement project at St. Thomas and for new telephone systems for St. Thomas and St. Croix. The former promises to be of great benefit, not only in its utilitarian aspects but as a tourist attraction. The telephone system was vitally needed to replace an obsolete and worn-out system constructed many years ago. Both projects are of considerable importance in the economy of the islands. Funds have been requested for next year for the construction of hospital facilities and school buildings in the islands, both of which are completely inadequate at the present time. Other facilities are provided for in the authorizing act that passed the Congress in 1944.

Agricultural Experiment Station

The Department of the Interior strongly supported legislation pending in Congress to transfer the agricultural experiment station to he Department of the Interior and to provide for a program of exension and experimental work by the Department of Agriculture. Such programs are important in the promotion of self-sufficiency of he islands.

Virgin Islands Corporation

In spite of limitations in important respects on the funds appropriated to the Virgin Islands Corporation, a small credit program was inaugurated for crop production, water and soil conservation, and industrial and commercial loans. This should prove to be a stimulant not only to the development of the tourist industry but to more extensive agricultural diversification and improvement. Credit facilities have heretofore been inadequate to assist materially in the improvement of the difficult economic conditions that the island face. This program should be expanded as an important means toward making the islands self-sufficient.

A combination of unusually good rainfall conditions and improved agricultural practices produced the largest sugar crop in decades. It is estimated that the final yield will be over 10,000 tons of sugar, as compared with 4,500 tons in 1949.

HAWAII

Action Toward Statehood

The fiscal year 1950 brought Hawaii as close to statehood as it could possibly come through its own efforts. Hawaii followed two major paths to reach this goal before the adjournment of the Eighty-first Congress.

First, every effort was made to win passage for the statehood enabling legislation. The House moved quickly and on March 7, 1950, the enabling bill was passed 262 to 110. From May 1 to May 5, exhaustive hearings were held by the Senate Interior and Insular Affairs Committee, with almost unanimous testimony for statehood by leaders from every segment of life in Hawaii and the mainland. On June 29, 1950, the committee reported out the bill with only one dissenting vote. The President and Secretary Chapman strongly and repeatedly urged the Senate to take prompt action on this measure.

Second, to demonstrate its ability to govern itself and its desire to accelerate the statehood process, Hawaii held a primary election on

February 11 and a final election March 24 for 61 delegates to a constitutional convention. Convening on April 4, the convention met for 3 months and drafted a constitution. Generally acclaimed as a concise, forward-looking, and thoroughly practical document embodying the best in the American democratic tradition, it was signed in Iolani Palace on July 22.

Economic Conditions

The economic picture, which had been gray early in the year as a result of the shipping strike and drastically curtailed military expenditures, brightened by July 1. Unemployment in the Territory declined from a high of over 35,000 to 25,261 on June 30. The island of Oahu and the cities of Hilo and Wailuki, which had been declared distressed areas in November 1949, were gradually finding their way out of their employment slump.

The basic reasons for unemployment were (1) drastic cut-backs of the civilian force in military establishments, (2) the prolonged water-front strike which extended from May to November 1949, and (3) the continuing increase in mechanization in the sugar and pineapple industries. The Governor appointed a full employment committee consisting of 14 representative citizens to formulate a comprehensive community program to alleviate unemployment. The seriousness of this condition was indicated by the fact that unemployment-insurance payments to industrial workers during the year totaled $4,972,711, a figure exceeding the total sum paid in 11 previous years of the program. However, average weekly earnings remained high and the cost of living in Honolulu showed a decline. Tax collections dropped severely during the year while tax delinquencies soared, but these were offset to some degree by a settlement in the Territory's favor of tax litigation releasing over $1,000,000 accumulated in a trust fund since 1942, pending appeals to the Supreme Court of the United States (*Brodhead* v. *Borthwick* and *Veatch* v. *Borthwick*).

Education and Health

In education and health the Territory maintained an admirable record. During the year public-school enrollment reached 90,786, compared with 86,835 in 1949. However, inadequate classroom space and school housing remained serious problems. The tuberculosis death rate fell to 21 per 100,000 population—well below the national average. A major administrative change in the health department came with the transfer of the Hansen's disease program to the health department.

The census taken as of April 1, 1950, placed the population of Hawaii at 493,348, as compared with 423,330 in 1940, with the population of the city and county of Honolulu accounting for all the increase by a rise from 258,256 to 347,440.

PACIFIC ISLANDS

TRANSFER OF JURISDICTION AND BASIC PLANNING

During the fiscal year 1950 great progress was made in developing civilian government under law in Guam, American Samoa, and the Trust Territory. While the Organic Act for Guam was not finally passed by Congress and approved by the President until August, all essential preparations for the transfer of the island from the jurisdiction of the Navy Department to that of the Department of the Interior were completed by July 1. This included the inauguration of Carlton Skinner as the first civilian Governor on September 27, 1949. Memoranda of understanding setting forth the transfer procedure in American Samoa and the Trust Territory of the Pacific Islands were concluded between the Interior and Navy Departments on September 23, 1949. Following the precedents of the earlier understanding for Guam, the memoranda provided for the appointment of a civilian Governor for American Samoa and a High Commissioner for the Trust Territory on or about July 1, 1951.

These legislative and administrative measures have been taken after careful study by responsible officials in consultation with the peoples concerned. In the fall of 1949 a visit to the island area was made by a committee of Congressmen—five from the House Public Lands Committee and two from the Post Office and Civil Service Committee. Headed by Congressman Miles, of New Mexico, the committee studied the feasibility of organic legislation, and held hearings in each island area. Upon its return to the United States the committee recommended the early enactment of organic legislation for Guam, American Samoa, and the Trust Territory. The legislation for Guam has been enacted. Similar legislation has been drafted for American Samoa and for the trust territory.

Realizing the difficult and, in many respects, unique administrative problems raised by the transfer of these islands to civilian responsibility, the Department during the past year requested and received an allocation of $50,000 from the President's Management Improvement Fund to conduct administrative studies in all three areas.

ADMINISTRATIVE SURVEYS

During February and March a team of experts, drawn from the Government and private industry, made a transportation survey in the Trust Territory to work out a dependable and economical system of civilian transportation in the area. After this group submitted its report to the Secretary of the Navy and the Secretary of the Interior in April its findings were made the basis of an air- and sea-transportation plan submitted to the President. On June 6 the President approved the plan and requested that the Navy and Interior Departments implement it in cooperation with interested departments.

A group of experts spent May and early June in American Samoa to study and make recommendations on the financial, personnel, and general governmental organization for the government of American Samoa when it is transferred from naval to civilian administration on July 1, 1951. Likewise, a survey team of experts in personnel, administration, finance, engineering, and in social and educational services spent most of May and June in the Trust Territory to make recommendations on the future civilian administrative organization for that area. The reports of these survey groups were being completed as the fiscal year closed.

For Guam the task was less one of projecting plans for the future but rather one of perfecting the organization and procedures of the civil government to meet current problems. As a basis for establishing a sound Territorial civil-service system for Guam, with the goal of equal pay for equal work, the Department engaged for the Guam government the services of the Public Administration Service. The team sent to Guam by this management consultant agency will recommend a personnel classification, compensation, and retirement system. In May a contract was also made with the same agency to send administrative and legal tax experts to Guam in order to improve present tax collection methods and to assess possible new sources of revenue. This study took on added significance with the inclusion by the Congress in Guam's Organic Act of a Territorial income tax at Federal rates for the island.

In all these surveys, the members enjoyed the closest cooperation from the Department of the Navy and from the officials in the islands.

MEDICAL PERSONNEL RECRUITMENT

Another program which the Department conducted for all the Pacific islands was the recruitment of displaced refugee physicians to serve in Guam, American Samoa, and the trust territory. In the belief that an adequate number of medical officers would be difficult to recruit in the United States, the Secretary of the Interior, after consultation with the Secretary of the Navy, approved a mission to interview physicians in European displaced-persons camps. Capt. Harry C. Oard, chief of medicine at the Oakland Naval Hospital and formerly director of the Guam Memorial Hospital, undertook the interviewing assignment on loan from the Navy in September. He returned to Washington in early November with a roster of qualified doctors. Nine doctors were selected for Guam, four for Samoa, and eight for the Trust Territory. From Captain Oard's roster four physicians for Puerto Rico and three for the Virgin Islands were also selected.

Guam Legislation and Civil Administration

The Department was vigorously engaged during the year in supporting congressional enactment of an organic act for Guam and laying the groundwork for the transfer of the island to civilian jurisdiction. A revised bill was introduced in the House by Congressman Peterson on February 13 and reported to the House by the Committee on Public Lands on February 22. House passage by unanimous consent came on May 23, 1950. The Senate Interior and Insular Affairs Committee held hearings on April 19 with Assistant Secretary Warne, Governor Skinner, and representatives of the Guam Congress among the witnesses.

The Office of Territories as well as the people and officials of Guam pay tribute to the diligence and understanding of the members of the committees of the Senate and House of Representatives who were responsible for consideration and passage of this legislation.[2]

Late in the year an omnibus agreement covering the post-transfer relationship between the government of Guam and the military forces was concluded between the Department of the Navy and the Department of the Interior. On each of the items included in the final agreement concurrence was received from the Governor of Guam. The agreement covered such matters as public utilities, highways, and the relationship of the military and civilian hospitals.

The Office of Territories sent a liaison officer to Guam to work with the naval government prior to and following the appointment of the civilian governor.

Immediately after his inauguration Governor Skinner turned his attention to the recruitment of civilian replacements for naval personnel in the government of Guam. He found that less than one-third of the 212 naval officers and men assigned to duty in the Guam government had to be replaced by stateside employees. These replacements were completed by June 30. As in the past Guamanians constitute the vast majority of government personnel.

At the request of the Governor, an official of the Department's Bureau of Land Management was loaned to the government of Guam to assist in the establishment of an effective system for managing the Territory's public lands.

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[2] The Senate subcommittee reported out the bill with amendments which was unanimously passed on July 26, 1950, by the Senate. The bill was signed by the President August 1, 1950.

Among the important steps taken to stimulate local business and growth was the sale to private ownership of the Guam News and the Guam Bank. The number of military personnel on Guam declined prior to the Korea conflict but activity remained high, and the service industries on Guam continued to prosper. A commercial port was placed in operation, managed entirely by civilians. During the year the Governor of Guam and leaders on the island were giving increased attention to the stabilization of the economy through increased agricultural production and development of new enterprises. Much remains to be done but the foundation has been laid for rapid political, social, and economic development of the Territory.

UNITED NATIONS AND FOREIGN COOPERATION

Members of the Office participated in several international conferences at which were considered matters of import to the Territories. These included (1) the Caribbean Commission, of which the United States, Great Britain, France, and the Netherlands are members, and which reports to the member governments on means of improving the economic and social conditions of dependent areas in the Caribbean; (2) the United Nations Trusteeship Council; and (3) the United Nations Special Committee on Information Transmitted Under Article 73 (e) of the Charter, which examines the information transmitted on non-self-governing territories and makes recommendations thereon to the General Assembly. This Office edits the information on the Territories under the Department's jurisdiction which is transmitted to the Secretary General of the United Nations by the Department of State.

Division of Geography

Meredith F. Burrill, *Director*

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THE DIVISION OF GEOGRAPHY was established to discharge the duties of the Secretary of the Interior with respect to the act of July 25, 1947, which established the Board on Geographic Names. The Division performs research and other staff functions relating to the standardization of geographic names.

A major part of the Division's work during 1950 was concerned with foreign geographic names. Geographic and linguistic research was performed, leading to the standardization of over 75,000 names in more than 50 foreign areas. Gazetteers were compiled containing 134,000 standard names; more than 330,000 names were edited on maps and textual materials for correctness of spelling and application; and approximately 9,000 miscellaneous place-name inquiries were answered. More than 2,000 individual foreign names were prepared for decision by the Board.

The standardization of domestic names was limited to the most urgent requirements of Federal agencies due to the very small appropriation made available for such work. Only slightly more than 900 domestic name cases were prepared for action by the Board and made decisions. A much larger domestic names program is needed if the accumulation of pending cases is to be reduced and the more urgent requirements of the Federal agencies are to be met in the future.

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United States Board on Geographic Names

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The Board on Geographic Names is an interdepartmental organization established for the purpose of standardizing geographic nomenclature for use by the Federal Government. Representatives of 11

Federal departments and agencies make up its membership. S. W. Boggs, representing the Department of State, was elected Chairman in October 1949, succeeding J. B. Hutt, Department of the Navy.

The Board and its committees held frequent meetings during the year to take action on nomenclature policies, to standardize names, and to act upon related matters. The volume of the Board's activities is reflected in the statistical data described under the Division of Geography.

The Advisory Committees on Antarctic Names and on Names in Alaska continued to be active in their respective fields. A supplement to Special Publication No. 86, the Geographical Names of Antarctica, was published during the year. Cooperation was obtained from several State name committees and from officials in Puerto Rico.

The Board is cognizant of the great need for cumulative publications of domestic decisions, none having been published in cumulative form since 1933. It is hoped that funds will be available for this purpose during the fiscal year 1952.

Division of Budget and Finance

D. Otis Beasley, *Director*

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BY DEPARTMENT ORDER NO. 2546, the former Division of Budget and Administrative Management was abolished, and its budget, finance, and investigations functions were transferred to the Division of Budget and Finance established by that order. The organization of the Division consists of an Office of the Director and three branches covering budget, finance, and investigations.

Acting upon the recommendation of the House Subcommittee on Interior Department Appropriations as expressed in the committee's report on the Interior Department appropriation bill for 1950, the Division was instrumental in effecting a complete revision and simplification of the appropriation structure of the Department and a realinement of the activity breakdown used for budgetary and accounting purposes. While the Division assumed the initiative in this undertaking its accomplishment was made possible through the cooperation and assistance of the staffs of the Appropriations Committee, the Bureau of the Budget, and the bureaus and offices of the Department. This revision establishes a definite pattern of appropriations under the categories of resource management; surveys, investigations, and research; construction and land acquisition; operation and maintenance; loans and grants; and general administration. It effects, also, a reduction from 167 to 42 in the number of appropriation items and eliminates superfluous appropriation text. It conforms with recommendations of the Hoover Commission for performance budgeting and will facilitate consideration of the appropriation estimates by the Department, the Bureau of the Budget, and the Congress.

In addition to participating in the revision of the appropriation structure, the Branch of Budget devoted its efforts to the development of budgetary policies, procedures, and standards to guide the original preparation of budget proposals within the bureaus, especially for conformance with the principles of the new appropriation structure. The Branch also supervises and participates in the presentation of the Department's estimates before the Bureau of the Budget and the Congress.

The Department's appropriations for the fiscal year 1950 totaled $603,062,057, an increase of $139,138,113 over 1949 appropriations. Of the total appropriated $18,963,260 was obtained through supplemental appropriation acts.

Upon approval of the new appropriation structure, the Branch of Finance, with the cooperation of the bureaus and offices of the Department, completed a chart of allotment accounts for each agency that will effect an integration of the 1951 budget structure with the accounts. The Branch also devised a financial reporting system to establish departmental control over allocations, apportionments, and obligations below the level of appropriations to insure that the funds are used according to the purposes for which authorized by the Congress.

The Branch of Finance continued to participate actively in the joint program of the Bureau of the Budget, Treasury Department, and the General Accounting Office for improving accounting in the Federal Government. The comprehensive study of accounting and financial reporting procedures in the Bureau of Reclamation, started during the fiscal year 1948 and being carried out by the staffs of the Bureau and the Department working in cooperation with the Bureau of the Budget, the Treasury Department, and the General Accounting Office, continued during the current fiscal year. Under the joint auspices of the Department and the General Accounting Office accounting and fiscal problems involving the Bureau of Land Management, Bureau of Indian Affairs, and the Bureau of Mines received special consideration.

The Branch of Investigations conducts investigations of complaints of irregularities in the performance of official duties by employees of the Department; investigates the records of guardians of incompetent Indians in cases where information is received indicating the guardians are not properly administering and accounting for the estates of their wards; investigates complaints of fraud or other irregularities in the letting of contracts on construction projects under the jurisdiction of the Department and investigates other miscellaneous matters to obtain information on which to base administrative decisions. Reports of investigations indicating possible criminal offenses are referred to the Department of Justice for decision as to the institution of criminal proceedings. The Branch of Investigations also assists in gathering information upon which to determine whether personnel employed in sensitive positions may be given security clearance.

Division of Personnel Management

Mrs. J. Atwood Maulding, *Director*

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DURING THE FIRST PART OF THE FISCAL YEAR the Congress passed more important personnel legislation than had been enacted in several years. Carrying out certain recommendations of the Hoover Commission, the following are among the most far-reaching of these laws: Public Law No. 359 providing increases in salaries for heads of Departments and certain other top positions in the executive branch of the Government; the Classification Act of 1949 setting up a different system of classification grades and pay schedules, combining the previous professional, subprofessional, and clerical, administrative, and fiscal services into one general schedule, and raising the ceiling to $14,000; also, the departments were given broader authority under this act; the Federal Employees' Compensation Act amendments of 1949, which increases materially the benefits for employees suffering injuries while in the performance of their official duties. Reorganization Plan No. 5 reorganized the Civil Service Commission and vested in its Chairman the responsibility for the administrative direction of its work. Public Law No. 92 modified travel and subsistence laws, increasing the maximum per diem from $6 to $9, and the allowance per mile for use of privately owned automobiles and airplanes from 5 to 7 cents.

The Classification Act of 1949 in particular caused a great deal of activity in the classification work. It was necessary to review all of the top positions of the Department to enable the Secretary to make adequate recommendations for the allocation of Department positions to the new grades GS–16, 17, and 18 established under the act. This act also brought under classification for the first time a number of positions in the Indian service and the Virgin Islands. On the other hand, certain groups of positions heretofore classified were determined to be exempt from the act. Many of these were of the type that do not lend themselves to wage-board treatment. Accordingly, an Interior general schedule was established, paralleling the general schedule of the act, the positions being allocable under the same standards. During the year, the Chief, Branch of Classification made a field inspection trip to several field areas in the interest of uniform application of classification standards.

As to employment, the dislocations caused by the war and its aftermath have been reaching adjustment. The rate of personnel turn-over has dropped to normal; agency authority to make interim appointments has mostly been withdrawn; with few exceptions, wartime nonstatus appointees have been separated or converted to probationary status. The Department's boards and committees of civil-service examiners have operated with success, and the system has been extended to certain additional positions peculiar to the Department. There are now 26 committees and boards of examiners, and during the year they handled upward of 17,000 applications. We have also worked out special recruitment programs for shortage occupations of medical officers and nurses. There has been increased cooperation between the Department and the colleges in recruiting programs, and an increased use of students as trainees prior to graduation.

June 30, 1950, brought to a successful conclusion the first year of the operation of the departmental management-training program. The initial group of 17 trainees, composed of promising young employees of the Department and recent college graduates who gave evidence of management aptitude, developed in a very satisfactory manner. The purpose of the program has been to provide the Department with a group of able young men and women who would be prepared for later assumption of more important staff and operating responsibilities. Assignments were designed to meet the individual needs of each of the trainees and the Department while on productive work under competent supervision. That this pattern has proved successful is apparent from the general acceptance of the program and the generous cooperation that has come from all quarters. In line with Department training policy there have been programs in some of the bureaus designed for the development of administrative personnel keyed to the bureaus' activities; the Director of Personnel participated in two of these conducted by the National Park Service at Albuquerque, N. Mex., and San Francisco, Calif.

The supervisor's forum continues with excellent results. Since it has not been practical to carry this work out into the field as yet, the Division of Personnel Management during the year sought and found a practical and inexpensive published text on supervision which it was able to recommend to the bureaus for use in the field service, and the bureaus bought and distributed some 1,400 copies. A class in verbatim reporting was begun during the year to qualify a small group of the Department's stenographers for conference work.

In line with the Department's policy, wages for ungraded positions have been adjusted periodically to keep in line with private industry, but the trend has been toward stabilization. Several public hearings were held during the year in which a member of the staff participated.

Pursuant to the general labor-relations policy statement issued by the Secretary in January 1948, a collective-bargaining agreement between the Department and a group of its employees at Coulee Dam has been signed and is now operating in that area. Steps to effect similar agreements are being taken by employees at Boulder City and the Sacramento Valley district of the Central Valley project.

The Branch of Inspection directed its attention to clarifying the important corelationships of responsibility that are established by decentralization of authority. Through the process of reviewing personnel administration procedures and gathering facts and identifying problem areas, the Branch has made suggestions and offered recommendations for improvement and simplification of personnel work. A complete review was made of the personnel activities in the Bureau of Indian Affairs both in the Washington and field offices with significant results.

Better to serve the bureaus and offices in Washington, and in the interest of good public relations, the central office serves also as a clearing house for applications for employment in person and by mail. During the year, 6,050 applicants called in person and 1,889 written applications were received. One of the placement officers gives one-third of his time to liaison work with the Civil Service Commission central office and other agencies to expedite cases for the various bureaus in Washington. The office also serves as a placement office for promotion and transfer across bureau lines and in enforcing reassignment rights in reductions of force, as well as conducting noncompetitive examinations in promotion cases.

There were 313 retirements during the year, of which 40 were for age, 186 optional, and 87 for disability. By Public Law 601 the Congress liberalized the benefits to those who retired prior to April 1, 1948, by allowing both survivorship benefits and the 25 percent increased annuity, where before an election had been required. Public Law 547 provided an order of precedence for payments to beneficiaries.

At the close of the fiscal year the total number of compensated employees was 65,573, of which 4,695 were in Washington, D. C., metropolitan area and 60,878 located in the field. Of the total number, 41,842 are classified by grade under the Classification Act, 19,331 under wage-board procedure, and 4,400 employees of various classes and ungraded. Veterans in the Department continue to increase now numbering 27,437. The number of women is 11,768.

During the year the Director of Personnel served as a member of the Federal Personnel Council and Chairman for the third consecutive year of its Personnel Legislation Committee, as a member of the

Department Loyalty Board and as a member of the Department Board of Awards.

Pursuant to the approval of Reorganization Plan No. 3, the Office of Administrative Assistant Secretary was created, under which all administrative management functions, including personnel, have been placed. The name of the Division has been changed from the Division of Personnel Supervision and Management to the Division of Personnel Management.

Southeastern Power Administration

Ben W. Creim, *Administrator*

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THE SOUTHEASTERN POWER ADMINISTRATION was established by Departmental Order No. 2558, dated March 21, 1950 (15 F.R. 291). This order delegated to the Administrator of the Southeastern Power Administration the authority of the Secretary of the Interior, under section 5 of the Flood Control Act of 1944 (16 U. S. C., 1946 ed., sec. 825s) to dispose of electric energy generated at reservoir projects under the control of the Department of the Army in the States of West Virginia, Virginia, North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Tennessee, and Kentucky.

The Secretary designated Elberton, Ga., as the location of the headquarters office of the agency. An office was opened on April 1 at Elberton, and the operations of the agency have been conducted from Elberton since May 1.

The Dale Hollow project was in operation during the entire fiscal year, and the power from that project was sold to the Tennessee Valley Authority, pursuant to a contract executed as of December 18, 1948. Revenues accruing from this contract during the fiscal year aggregated $1,081,400.

The Allatoona project commenced operation on restricted basis on February 3, 1950, and the second generating unit at that project was placed in operation on June 10, 1950. Power from this project is sold to the Georgia Power Co., pursuant to a contract executed on August 3, 1948. Revenues from this contract during the fiscal year amounted to $248,191.57.

There are seven additional projects presently under construction. The first of the projects to commence operation will commence during fiscal year 1951, and the last of the projects to be completed will be completed during fiscal year 1955. The administration has been concerned primarily with negotiating arrangements for the sale of power from these projects. It has contacted many of the approximately 400 preferred agencies in its area, and has engaged in discussions with cooperative groups, public bodies, Government agencies, and private power companies.

Interior Department Museum

H. L. Raul, *Museum Curator*

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THE INTERIOR DEPARTMENT MUSEUM was established on March 8, 1938. It is a unit of the Office of the Secretary, Division of Administrative Services. For more than a tenth part of the century of conservation, during which century the Department of the Interior has served the Nation in developing and conserving vast national resources, the Interior Museum has been active in visualizing to the public the history, aims, and current activities of the Department.

The museum attracts many American tourists, some arriving in large adult groups as well as numerous individual citizens, and visitors from foreign lands. The general public, including many school and college students, finds the museum a valuable place for study and instruction.

The Secretary's UN Reception

On the evening of September 12 the museum was the scene of an official reception given by the Secretary of the Interior to 147 delegates, from 48 nations, attending the United Nations Scientific Conference on the Conservation and Utilization of Resources.

Attendance and Foreign Visitors

Museum visitors during the past year numbered approximately 32,000 persons. Visitors were listed on the visitors' register from every State in the Union, and from Alaska, Canal Zone, Hawaii, Puerto Rico, and the Virgin Islands. Foreign registrations were from Argentina, Austria, Belgium, Bermuda, Brazil, Canada, Chile, China, Colombia, Cuba, Denmark, Dominican Republic, Ecuador, El Salvador, England, Finland, France, Germany, Holland, India, Irak, Iran, Israel, Japan, Luxemburg, Mexico, Norway, Pakistan, Panama, Peru, Philippines, Spain, Sweden, Switzerland, Thailand, Turkey, Union of South Africa, Uruguay, and Venezuela.

Special Exhibits

The special series of monthly centennial exhibits, begun in March 1949 and formerly reported through June, were continued throughout the centennial year, as follows:

July.—Bureau of Indian Affairs.—Jewelry produced by skilled Eskimo craftsmen to be used as models to aid in developing combination of ivory with silver, jade, and other materials found in Alaska.

August.—Division of Personnel Supervision and Management.—Large framed graphic chart indicating the expansion during the past century of the activities of the Department as reflected in the number of employees through the years. This panel also includes portraits of all past Secretaries of the Interior.

September.—Bonneville Power Administration.—Exhibit illustrating Bonneville Dam and power plant, with detail charts and maps referring to electric energy generated at Bonneville and Grand Coulee Dams; and other Columbia River projects authorized for future construction in the Columbia River power system.

Southwestern Power Administration.—Exhibit illustrating Norfork Dam and Fort Gibson and Tenkiller Ferry Dams construction and other hydroelectric projects in the Southwestern Power Administration area, with existing and proposed Government transmission lines.

October.—Office of the Secretary, Suggestions Committee.—Commendable-service-awards exhibit cabinet with hand-tooled art-leather book, listing names for permanent record.

National Park Service.—Seventy illuminated scenes of the national parks, automatic slide projection.

November.—Bureau of Reclamation.—Large framed exhibit in color illustrating Hungry Horse Dam project, with descriptive material.

December.—Bureau of Reclamation.—Panel exhibit, 22 feet long, with diorama and automatic slide projector, showing multiple-purpose reclamation development.

January.—Division of Territories and Island Possessions.—Exhibition of eight life-size pastel portraits of native Eskimo and Indian subjects done in Alaska by Mrs. Nina Crumrine.

February.—Fish and Wildlife Service.—Collection of 13 large illegal "Scow guns" and "Armada guns" used in wild duck slaughter; confiscated by Fish and Wildlife Service.

Accessions.—Hillers Collection of Indian Materials.

An important accession is the collection of 74 Indian artifacts collected by the late John K. Hillers who was a member of the geological and geographic survey expedition of 1869–72, headed by Maj. J. W. Powell, which explored the canyon of the Colorado River. The Hillers collection was presented to the National Park Service on June 2, 1950, by Mrs. John K. Hillers, Jr., and on the same date transferred by the National Park Service to the Interior Department Museum.

Collaboration With Bureaus

Continuing contact with the bureaus, numerous case installations and revisions have been made, including: Bureau of Land Management—large tinted chart of unusual design indicating Highlights in the History of the Public Domain; Division of Territories and Island Possessions—model, 6 feet long, of native outrigger canoe from Ifalik, western Caroline Islands, territory of the Pacific (loan exhibit from Lt. N. J. Cummings, United States Navy); Bonneville Power Adminration—large framed map and graphic chart, Federal Transmission System, including 6-year construction program proposed for mpletion or under construction by 1955; Bureau of Reclamation—rge map illustrated with plastic models, showing Products of Reclamation Projects; another new exhibit of marked interest is a framed splay panel exhibiting the Meritorious Service silver medal awarded "Operation Snowbound" unit, with certificate and citation.

The long-damaged mural oil painting, Signing of the Alaska Treaty, as been successfully repaired and restored. A revised edition of the useum-illustrated descriptive folder was issued during the fiscal year.

Cooperation With Other Agencies

Services of assistance in display programs and consultation in visual lucation techniques were rendered, upon request, to a number of gencies, including American Automobile Association; Bureau of the Census; National League of American Pen Women; Pan American Union; Geography and Map Division of the Special Libraries Association; State Department; and Rutgers University.

School Classes and Organization Groups

During the year many school and college classes visited the museum n supplementing their conservation, history, and scientific courses. Guided museum tours were given. These student classes were from ocal and from distant schools such as Dover, Pa., High School; Cambridge School, of Weston, Mass.; Elizabeth Irwin High School, of New York City. Among the larger single groups were 107 members attending the Washington student citizenship seminar, and the Dolly Madison High School, Arlington, Va., group of 100. It also is noteworthy that, upon advance air-mail appointment, a group of 51 enterprising students of the Port Huron, Mich., High School, accompanied by three faculty members, chartered a large airplane and flew here for a guided lecture tour of the museum and to view other points of interest in the Nation's Capital.

The museum was held open evenings and Saturdays on several occasions to accommodate special groups not able to attend during regular museum hours.

Publicity

At the information counter inquiries were handled daily and special services rendered whenever requested. References to the museum appeared in several Washington guide books and other publications. The generous assistance and cooperation extended during the year by the offices and bureaus afforded much benefit to the museum and is gratefully acknowledged.

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DEPARTMENT OF THE INTERIOR
March 3, 1849

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1951 Annual Report

OF THE SECRETARY OF THE INTERIOR

Oscar L. Chapman

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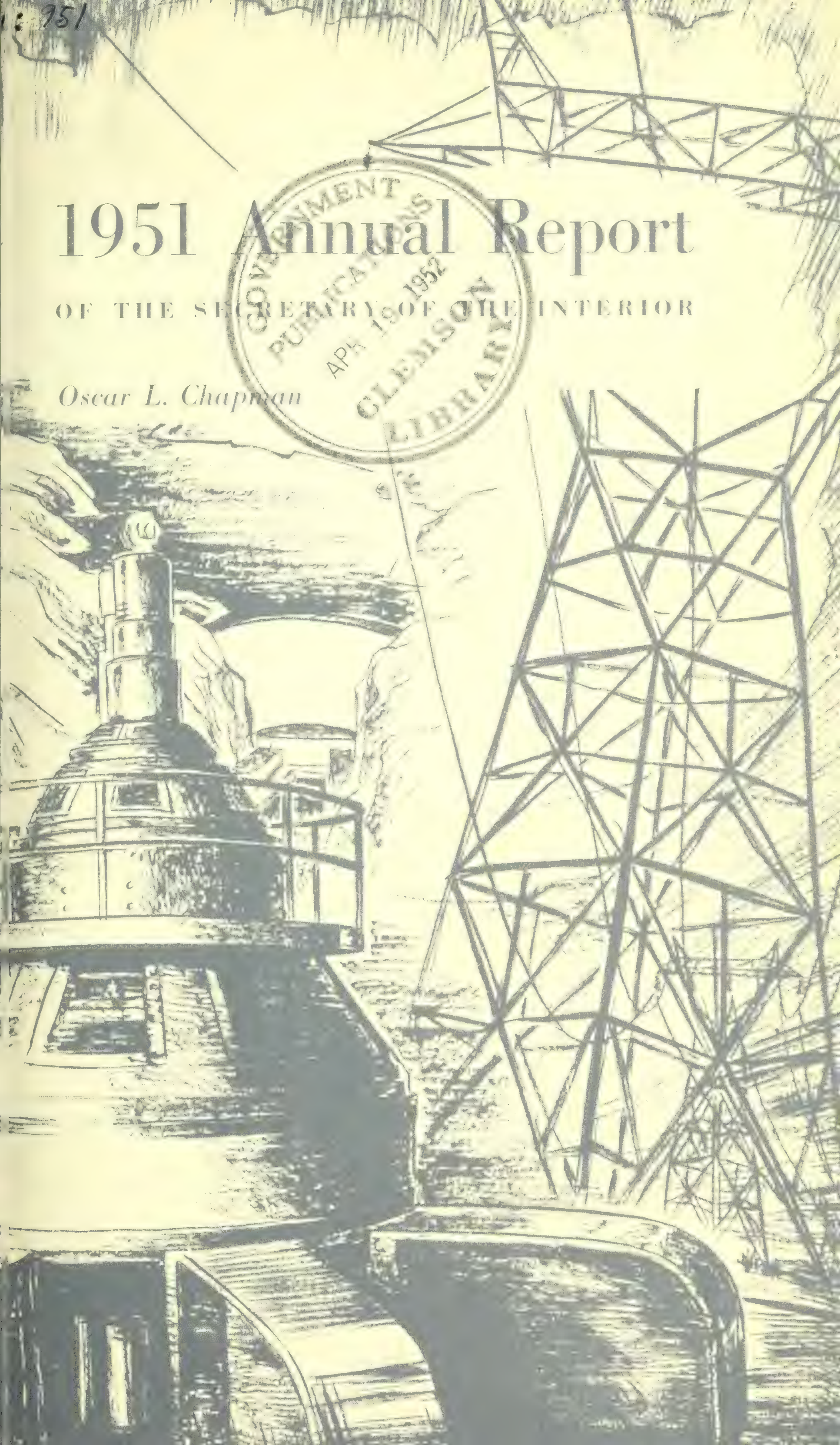

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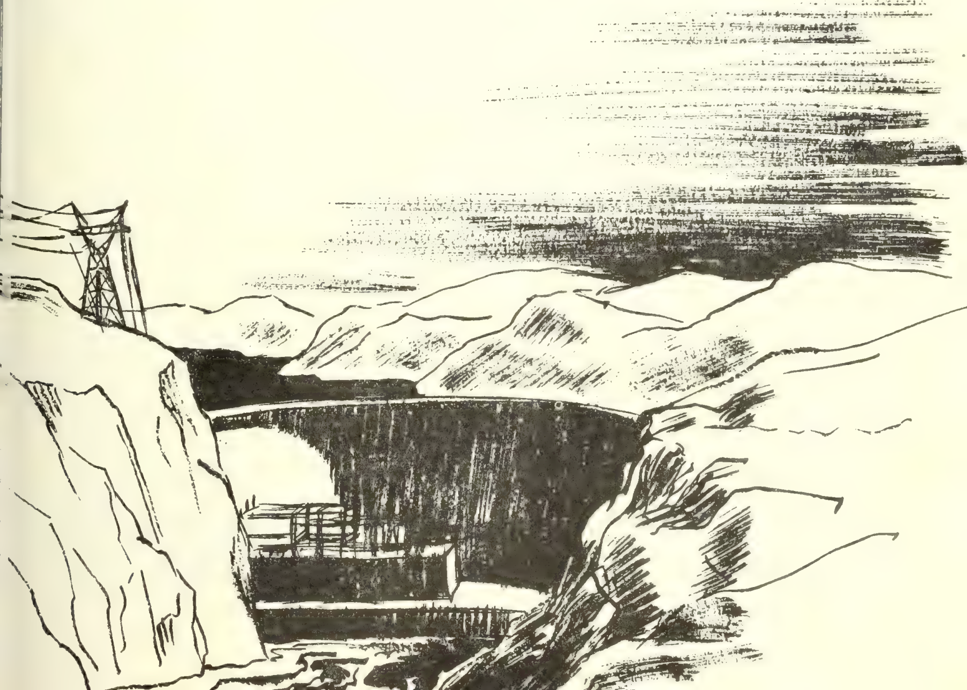
OF THE SECRETARY OF THE INTERIOR

Fiscal Year Ended June 30, 1951



UNITED STATES

DEPARTMENT OF THE INTERIOR

Oscar L. Chapman, *Secretary*

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Resources for Defense

THIS NATION is engaged today in an entirely new kind of defense program, which has an immense impact on our natural resource base. As a result, America is facing a problem whose proportions and implications are unlike anything we have ever faced before.

Our immediate responsibility is to build up the military machine. Our survival as a people may well depend on our ability to turn our great potential strength into military striking power on short notice. In our great economic mobilization program the primary object is to make our economic strength mean immediately available military power.

Yet that is only half of the story.

While we do that, we are also obliged to build up our basic economic strength. It is by no means enough for us to become strong enough to meet the possible international crises of the next 2 or 3 years. In the long run, we have to make America a richer and more productive Nation—not just for the next 2 or 3 years, but for coming decades or even generations.

We could make no greater mistake than to assume that we could meet the immediate challenge at the cost of our long-run development.

In the last analysis, the fate of this Nation will ultimately depend on the condition we are in after the immediate challenge has been met.

The real question is not whether we shall meet the challenge. Every American is confident that we shall do that, whether it takes 2 years or 20, and whether it is met peacefully or in all-out conflict. The real question is what shape we are going to be in after the emergency has been passed.

If we come out of this time of trial weaker and poorer than when we went in—less able to provide our people with the goods and services they need, weaker in all of the fundamental things that go to make up national strength, enfeebled because we have dissipated our basic resources in order to produce the planes and warships and bombs and other armaments that we need, saddled permanently with a lower standard of living and a harder, more despairing struggle for existence—then we shall find that we have actually lost the struggle, no matter what has happened to the totalitarian regimes which now threaten our existence.

Indeed, the final test of victory will lie in the answer to the simple question: Is America richer, stronger, better able to provide her people with a good life and to assume her position of world leadership than she was before the challenge was first raised?

If the answer is "Yes," then we shall have won, and if it is "No" then we shall have lost. It is just as simple as that.

This compels us to examine our position in respect to our basic resources of land, water, and minerals with the most extreme care and the clearest intelligence.

It means, for example, that in this emergency period we dare not treat our resource conservation programs as expendible luxuries. They are not programs that can be laid aside because we have something more important to do. On the contrary, these programs—which at bottom mean that we are determined to plan ahead, to provide for our future well-being by developing to the fullest utilization all of the great resources with which nature has endowed us—are at the very heart of the "something more important" which is now engaging our attention.

In his Economic Report to the Congress last winter, President Truman properly expressed the case when he said:

> The rapid expansion of the defense program must be the first objective in all that we do. But military strength does not depend upon guns and armed forces alone. These forces must be equipped by our industry, fed by our farms, and supported by all the people. There must be a continuing balance between the buildup of military strength and the buildup of economic strength.
>
> In a total war, this balance would be very different from what it should be now. In a total war, we would have total military mobilization, accomplished by considerable depletion of other kinds of strength. In the current situation, we must place considerable stress upon economic strength, or run the risk of being weak at some future time if total military strength should then be required. . . .
>
> If we allow our agricultural and range lands and our forests to deteriorate, and if we misuse critically needed minerals and supplies of water, we shall become weaker each year instead of stronger. If we do not expand the use of some of these resources—we cannot expect to reach the full potential of our industrial strength.

The first point we need to realize is that the defense effort we are making could easily become a devastating thing, disastrous to all of our prospects, if we should concentrate solely on short-term goals.

It would be fatally easy for us to do this. The pressure to make us do it is upon us every day that this emergency continues.

As an illustration, consider the case of iron ore—which is certainly one of the basic resources for any modern nation.

Our immediate task is to expand our production of iron ore in order to meet the current needs of our defense program. We are expanding our capacity to make steel, and it is of the first importance that we expand our ability to produce iron ore in pace with that expansion.

But if we stop there we could easily put ourselves on the high road to ultimate ruin. For if we do that and nothing more—if we simply increase the rate at which we use up our irreplaceable resource of high-grade, easily accessible iron ore—we bring closer the day in which we would not have enough iron ore to support our normal, peacetime industry, let alone a great defense program.

Consequently, as we increase our production of iron ore we must at the same time spend a certain amount of money, energy, and material in making certain that our continuing, long-range supply of ore remains adequate to meet all future demands upon it. That means increasing the research on the metallurgical processes by which low-grade ores can be used. It means doing the things that are necessary to make new deposits available: such things, for example, as constructing a Great Lakes seaway, so that rich deposits in Labrador and elsewhere can be brought speedily and economically to our steel-producing centers. It means a sustained attack all along the line, so that we can always be sure that our immense steel industry can meet all of the manifold demands which a wealthy, powerful, and prosperous country may place upon it.

Another case in point is provided by electric power.

The great tendency at the present time is to refuse to devote any critical materials to an expansion of our electric power supply unless it can be shown that the expanded capacity will contribute directly to national defense within the next couple of years.

If we give way to that tendency, we might indeed find that at the end of 2, 3, or 5 years we had met our purely defense needs to the last kilowatt of installed capacity—and, at the same time, had left ourselves hopelessly crippled because we did not have enough electric power to meet the normal demands of our ever-expanding industry. Our total requirement for electric power then would vastly exceed our total ability to produce that power, even though we had made every increase demanded by the defense program itself.

In both of those two cases—iron ore and electric power—we could meet our defense goals and still find ourselves in worse shape than we had been in before, either because we had nearly exhausted an irreplaceable resource, or because we had failed to make provision for the normal growth of the country. As a result, we should be poorer than we were before the emergency began; permanently poorer, less able to survive in prosperity and happiness in a world at peace.

The second great point to bear in mind is that the immense demands of our defense program have come on top of a great, continuing expansion in our domestic economy.

That expansion is the very essence of our development as a Nation.

Even before the Korean crisis was thrust upon us, it was obvious that our expanding economy would place continuing increased demands upon our resources. To put it in another way, even by 1950 we could see that we would be obliged to develop our resource base in order to support a greatly enlarged economy.

The new mobilization plan, accompanied by the threat of a possible all-out war, came on top of that expansion. There was no slack for us to take up—no reservoir of unused productive capacity waiting only to be tapped.

In normal times, the interplay of supply-and-demand factors might adjust the situation. But during the defense program times are far from normal. We are conducting neither a peacetime economy nor an all-out-war economy, but one which is a singular blend of both.

In doing this we are trying to meet two sets of demands at once—the demands of our military program, on the one hand, and the demands of a constantly expanding civilian economy on the other. The result is that the basic utility type operations—power, mining, land development, and the like, the things which create the foundation upon which the entire economy rests—inevitably get caught in the middle and squeezed. Their requirements tend to get a low rating, and the materials which are needed for their development simply do not get delivered.

If we let matters continue in that way we run a grave danger of saddling ourselves with a straight military economy.

If that happens we shall find that the old economic freedoms which give American life so much of its richness have disappeared. We shall be supporting an enormous budget, with a huge proportion for defense, and yet find ourselves poor as church mice where our great basic programs are involved. Yet those programs—irrigation and land development projects, proper care for our national park system, intelligent development of our river systems, and so on—are the things which make the difference between the rich cultural society we are used to and a pinched, Spartan existence which is inevitable under a straight military economy.

For instance, we are nearing the ceiling on the growth and stability that can be achieved by our Western States without increased, broad-scale irrigation and related water resources development. For the extent of water resources development rigidly sets the limits to which the western economy can expand and thrive, and with direct and extensive effect upon the economy of the entire United States.

Of course, all of us will be willing to endure a Spartan existence if that should become necessary in the course of a world war. But it would be simple folly for us to condemn ourselves to such an existence unnecessarily simply because we failed now to develop our resources so that they can carry the increased load which we are placing upon them.

The third great point which must be borne in mind is that while we may face limitless demands upon our resources, those resources are not in fact unlimited.

An absolutely essential part of this vital program of developing our resources is to make proper provision for the use of resources from beyond our own shores. In the long run, we shall have to realize that the entire world is our resource base—just as we ourselves are part of the world's resource base.

Do what we will, we cannot survive by building a Chinese wall about ourselves—not unless we are willing to accept a permanently lower standard of living, which will become progressively worse instead of better.

Ultimately, we, more than any other people, need the kind of world in which there can always be a free movement of goods and services from country to country.

What we are looking for from beginning to end of this time of trial is, to repeat, a situation in which we can meet all of the requirements of our growing, expanding, vigorous population, and carry the great responsibilities which inevitably come to a free society which has been placed in a position of world leadership.

We cannot do that by relying on a blind belief in our own self-sufficiency, nor can we confine ourselves simply to an attempt to meet the immediate goals of military preparedness. We need to realize our own place in the world—a world in which the free nations must to a large extent share a common fate, each developing its own resources to the utmost in order to broaden the base upon which free economic institutions rest. As we meet our military goals we must forever remember the need to expand our reserves and to make the best possible use of the resources which are available to us, whether those resources lie within our borders or in the lands of nations with whom we carry on a mutually beneficial exchange of goods.

As a Government agency which is primarily concerned with the conservation and development of our basic resources—the soil, minerals and water and the energies and riches that come from them—the Department of the Interior is intimately involved in this effort. Consequently, when the President decided to delegate certain duties under the Defense Production Act to existing Government agencies, a number of specific responsibilities were charged to this Department. These have to do with minerals, electric power, solid fuels, petroleum and natural gas, and fisheries.

As a result, five defense agencies were set up under the Secretary of the Interior—the Defense Minerals Administration, the Defense Electric Power Administration, the Defense Solid Fuels Administration, the Petroleum Administration for Defense, and the Defense Fisheries Administration.

Each of these agencies was built around a nucleus of personnel, experience, and peacetime duties in the Department of the Interior. The Defense Minerals Administration, which is responsible for the important domestic minerals exploration program, was developed around skilled people drawn from the Bureau of Mines and the Geological Survey. The power agencies in the Department contributed to the staff for the Defense Electric Power Administration, and the Petroleum Administration was built around the Oil and Gas Division in the Office of the Secretary. The Fisheries Administration was organized around trained personnel from the Fish and Wildlife Service, and the Defense Solid Fuels Administration developed logically around departmental functions normally concerned with coal and coal mining.

Thus the agencies which are directly concerned with programing and providing the Nation's supply of certain critical materials and energies during the emergency work closely with the agencies which in ordinary times of peace deal with the industries and resources which are involved. The work is tied together through a small Defense Production Staff in the Office of the Secretary; and through all of these means, the Department works to get an adequate supply of our basic resources for military needs and to bring about an adequate expansion of production in these fields.

MINERALS

Metallic and nonmetallic minerals are raw materials vital to this Nation's economic strength and to its military might. Although we are very far from a have-not Nation, our resources in the field are by no means so great that we can afford to waste them. In this defense emergency, we need more than ever to practice the wisest sort of conservation—which means, not simply locking our resources up and keeping them untouched for use in some indefinite future, but using them in such a way that we get the greatest value out of them while at the same time we make certain of our future supply.

Because of the scientific and technical knowledge and skills in the Bureau of Mines and the Geological Survey, the Department was able to move rapidly in the past year to attack the complex problems which are raised in this field by the existence of the defense emergency program.

Minerals differ from other natural resources with which this Department deals in that they are wasting assets. Once a deposit has been mined out it is gone forever, except for scrap recovery. This means that it is precisely in a time like the present that it is most important to intensify long-range programs designed to promote their conservation.

It is important to realize that today's producing mines are the fruit of planning, development, and preparatory work begun many years ago. The production of a decade hence must be planned today. Development of mineral resources requires large outlays for systematic exploration, for mining and metallurgical machinery, for the extension of transportation into remote areas, for the recruiting and training and housing of workers, and for the development of technologies for the treatment of low-grade ores. Only on the basis of forward looking planning is it possible to work today's operating mines at a given level of production with confidence that a future generation will have adequate sources of production from which to draw its essential materials.

In 1951 a careful balance was necessary between immediate and long-range planning. Even though the Defense Minerals Administration was set up to handle immediate defense needs, it was not possible to recess much of the established work of the Bureau of Mines and the Geological Survey, because that work is a necessary part of the emergency program. It has also been necessary to bear in mind that the Nation might eventually face an unlimited emergency in which plans must be ready for the exploitation of submarginal ore bodies without regard to cost.

One part of the Bureau of Mines work which is extremely important in time of emergency is its conservation of trained manpower through the prevention of injuries in the mines. For 41 years the Bureau has been striving to make mines and plants safer, and its efforts have borne fruit. In 1950, for example, there were about 28,500 fewer injuries and only half as many fatalities in the mineral industries as in 1940. Passage of the Coal Mine Inspection and Investigation Act of 1941 gave the Bureau a new weapon in its war upon coal-mine accidents, and in 1950 the fatality rates in bituminous and anthracite coal mining reached the lowest point in the statistical history of American coal mining. In recent months, however, the favorable trend was reversed, and there is need today for an intensification of accident-prevention work by State and Federal agencies and by management and labor.

Comparing the current minerals position with that which existed just before World War II shows a heavier production of most metals and minerals, together with increasing dependency upon imports and accumulated strategic stocks. During and after the last war, tremendous drafts were made upon known mineral reserves. However, a long-range program of exploring for new ore deposits, delineating undeveloped and submarginal ones, and advancing mining and metallurgical knowledge to make formerly submarginal deposits commercial, has done much to maintain the balance between reserves and production.

It is of the highest importance to maintain the country's reserves of essential minerals to as great an extent as possible. This requires the discovery of new deposits and the exploration and development of known ores. The defense exploration program has far-reaching implications. It may yet show that industry and Government, working together, can restore our mineral reserves as rapidly as even the present expanding industrial economy can consume them.

A complete inventory of our mineral deposits would be meaningless without an equally complete appraisal of the technology for recovering and utilizing the contained metals and minerals. Continued research lowers the cost of mining and processing ores, and at the same time increases the utility of the end products. Hence it is vital, in time of emergency, to resist the temptation to drop long-range studies on the improvement of metallurgical techniques and work exclusively on projects that will increase current production. We dare not arrest our progress in mineral technology.

Thus the search for feasible methods of using low-grade deposits of manganese, chromium, and other strategic minerals, which has been emphasized in recent years, has done much to reduce the danger of critical shortages. Pioneering research on the production of ductile titanium and ductile zirconium as new industrial metals, which already are supplementing the inadequate supply of heat- and corrosion-resistant metals, is assuming great importance. Here, incidentally, is an excellent example of the best sort of mineral conservation, since it points the way to wider use of resources which previously have had only limited utility.

Owing to the importance of aluminum in aircraft manufacture, the demand for this metal is especially responsive to military and defense activities. One of the Department's first actions under the Defense Production Act of 1950 was to launch a large aluminum-production expansion program, and in cooperation with other Federal agencies contracts were arranged for new construction to increase industry's capacity by 60 percent. Plans are also being made for providing additional hydroelectric power, new sources of bauxite and other ores, petroleum coke, soda ash, fluorspar, and other raw materials to supply the further expansion that is likely.

The critical situation of the United States in its supply of copper in a period of high world-wide demand was abundantly emphasized during World War II. When the present copper program was drawn up, no financial incentive from the Government was needed to bring about capacity operation of domestic and foreign properties of American copper-mining companies. It was recognized, however, that for the long pull it would be unwise to try to force these mines much above their most efficient operating levels, and the program therefore looked to the development and exploitation of certain deposits that are now idle and for a vast expansion of our purchases of copper overseas.

Long-term purchase contracts have provided the incentives, and within a few years both domestic and foreign copper production should be increased substantially. The situation remains grave, but much has been accomplished, and when the full program is completed it is hoped that we can minimize the inevitable restriction on the use of copper for other than military and defense-related purposes.

It is interesting to note that the first and biggest copper project on this program is based on a deposit whose development stemmed from an exploration project of the Bureau of Mines and Geological Survey begun in 1943. The project was such as to offer no prospect of production in less than 5 to 10 years; nevertheless, despite the pressure of World War II, that project was pushed, with the result that our present copper stringency may be substantially relieved by a major new source.

When Russia sharply cut manganese shipments to the United States, about a third of the supply on which the domestic iron and steel industry relied from the end of World War II until December 1949, was cut off. Our manganese program for 1951 emphasizes the need for new sources of usable manganese ore, the importance of research, and the exploration and development of new manganese reserves. The solution of problems relating to the conservation of manganese will continue to be an important part of this work.

It is extremely important to bear in mind that, although the United States is more richly endowed with mineral resources than most nations, we are becoming increasingly dependent upon imports for an ever-broadening list of essential raw materials. These come from all over the world—tin from Malaya, nickel from Canada, manganese and chrome from Africa, oil from Venezuela, copper from Chile, lead from Mexico, to mention but a few.

The picture becomes clear when statistics for 1950 are compared with those for a period as recent as the 5 years from 1935 to 1939.

In the earlier period, domestic petroleum production was 9 percent greater than domestic requirements; last year it was 9 percent smaller. In 1935–39, domestic mine production was 7 percent greater than domestic consumption of primary copper; in 1950 it was 39 percent less. In 1935–39 we imported only 7 percent of our lead and 5 percent of our zinc; in 1950, we imported 49 percent of our lead and 46 percent of our zinc.

We habitually import 75 percent or more of our supply of such strategic minerals as tin, nickel, cobalt, chromite, manganese ore, industrial diamonds, mica, asbestos, and platinum. We import from

25 to 75 percent of our supply of such minerals as bauxite (the principal ore of aluminum), tungsten, and fluorspar.

Such figures graphically illustrate the impossibility of any attempt on our part to live in self-sufficient isolation from the rest of the world. They also help to underline the importance—from a point of view of sheer self-interest—of the attempt of that part of the point 4 program which undertakes to assist other nations to increase their production of such strategic minerals. When we help underdeveloped areas to help themselves, we help to relieve ourselves and the rest of the free world of the current pressure of minerals shortages.

These figures also indicate the importance of providing ourselves with full current information about foreign minerals sources. At present our information on such sources lags far behind our information on domestic sources. Since we can hardly afford to operate our mineral economy without full knowledge of all the factors affecting it, a major expansion of the foreign statistical and informational activities of the Bureau of Mines is strongly recommended.

Indeed, we need more of the basic information on which our own domestic mineral sources are developed and exploited. The demand for geologic maps and geologic information presses heavily upon the Geological Survey, and if the ever-increasing demands are to be met, its resources studies and systematic geologic exploration for new deposits must be accelerated.

For a long time the Survey has been engaged in research on mineral deposits and in assembling and analyzing pertinent resources data. These data have been furnished to various Government agencies concerned with national defense, and to the Congress. The Survey's functions in this field have been extended by delegation of the authority vested in the President by the Defense Production Act of 1950, and the Defense Minerals Administration in its effort to encourage expansion of minerals production makes full use of the Survey's facilities.

If the economic strength of the Nation is to be maintained for the future, the activities of the Survey in the minerals and fuels fields must by all means be continued and speeded up. Private industry depends in large part on the Survey for comprehensive geologic data on which to base exploration programs, and for new and improved geologic, geochemical, and geophysical prospecting techniques. To be fully effective, the search for new deposits will require the acceleration of both research and geologic mapping.

Also of importance are the topographic mapping activities of the Survey. Soon after the outbreak of the Korean war, the Department of the Army asked the Survey to expedite its topographic mapping program throughout the United States, and, specifically, to complete the mapping of certain areas considered critical in national defense. In recent months the Survey has been reorganizing its mapping program so as to meet these requirements, fulfillment of which will mean several years' work. It should be added that, aside from their military importance, these topographic mapping activities are of substantial value in connection with the Nation's long-term economic expansion.

LAND AND WATER

The most fundamental of all our resources are the simple ones of land and water. In the long run our strength and prosperity rest upon them. Nothing in our entire program is more important than the task of making certain that these resources do not fail us.

In the old days we assumed that these resources were literally inexhaustible. A people who had a virgin continent to exploit—a continent, moreover, which was uncommonly rich in its soil and its forests and its lakes and streams—would naturally reach such a conclusion. No matter how much new soil was brought under the plow, no matter how many forests were cut down, no matter what damage was done by flood and erosion and stream pollution, it always seemed that plenty more lay just beyond the horizon.

As a result we used these resources with prodigal abandon, and the inevitable consequence was a great wastage.

This wastage we have begun to correct; for we have at last been forced to realize that this "inexhaustible" bounty is not in fact inexhaustible at all. On the contrary, we are pressing very hard upon these resources now. If we do not do our utmost to make the best use of them, and to plan for their wise conservation and development, we shall ultimately find that we lack the foundation for continued growth and prosperity.

The immense acreage owned and administered by the Government is what remains of a tremendous stretch of land from which 29 States and a Territory were carved and upon which millions of privately owned homesteads were provided. This remainder still offers present and potential resources of inestimable value to the Nation. These resources—many of them renewable if properly administered—include timber, oil, forage, coal, uranium, and many other strategic materials urgently needed not only for national defense but in the normal development of our expanding economy.

Proper administration of these lands begins with cadastral surveys and land classification programs. These surveys, which are basic to all of the Bureau of Land Management activities, enable timber sales to be made on intermingled private and public lands. They establish boundaries on oil lands so that private companies can lease from the Government and keep a supply of petroleum flowing. They pave the way for power and irrigation projects in all of the western States, help to meet the needs of agriculture and the livestock industry, straighten out private, State, and Federal boundary lines so that States can get revenues for schools and roads, and—not least important—help to keep land records straight so that future generations of private citizens may have clear title to their holdings.

Such surveys and studies not only meet the demands of private interests, but also make possible proper handling of hundreds of requests made by defense and other Government agencies for withdrawal of public lands for bombing ranges, for atomic energy sites, for wildlife refuges, for reclamation development, and so on.

Soil and forest management programs are important in the administration of these public lands. Under the Taylor Grazing Act, livestock can be fed upon approximately 180 million acres of federally owned range land, while soil conservation activities open up new reserves of forage and provide for protection of valuable watershed areas, through a concerted program for rebuilding long neglected range lands. Approximately 158 million acres of commercial forest land and woodland come under the jurisdiction of the Bureau, and a cardinal principle of management on these lands is that a perpetually sustained yield of timber must be achieved. When so managed, forests supply the economic foundation for a permanent wholesome community life for local communities, and in addition produce an unfailing supply of necessary forest products for the Nation as a whole.

It is interesting to note that on a straight dollars-and-cents basis the management of these public lands is carried on at a substantial profit to the Nation. During the 1951 fiscal year, $8,300,530 were appropriated for management of public land and resources, and State and Federal treasuries received an estimated $49,082,331 in receipts. In other words, $5.90 were returned for every dollar of appropriation. This, of course, includes only the tangible cash benefits and does not take into consideration the immense long-range values which come from proper management of our public lands.

Yet publicly owned lands are, after all, only a part of the great land resources which must be conserved and developed.

We are still an expanding country, and our population continues to grow. The Bureau of the Census predicts that the population of the United States will total 190 million people by 1975. To feed and clothe these people will require the equivalent of 99 million acres in new agricultural production.

That figure is basic to any consideration of America's handling of its land and water resources. It measures the urgency of the job—a job, be it noted, which has no connection whatever with the defense emergency but simply indicates the increased load which normal expansion of our economy is thrusting upon us. Any increased strain which arises from the defense program comes on top of that.

In addition, there is especial pressure for expanding irrigated croplands in the West, where population is growing faster than the national average. The Nation's population rose slightly less than 15 percent in the 1940–50 decade, but the population of the 17 western States went up nearly 25 percent. Despite the extensive reclamation work done in that decade, we are not meeting increased water and irrigation demands anywhere in the west today. The population of the three Pacific Coast States—Washington, Oregon, and California—showed a 47.5 percent increase in those 10 years.

What all of that means is that our population is beginning to press heavily on the basic source of our food supply. The pressure will continue for the next quarter century. The only feasible methods for relieving it involve bringing new lands into production through reclamation, and increasing production from land now in farms—or relying upon the importation of food from foreign countries. Obviously, we cannot relieve the pressure unless we make and carry out large plans for reclaiming presently unproductive soil.

An example of such planning is to be found at Grand Coulee Dam on the Columbia River in Washington, where on June 15, 1951, one of the most spectacular reclamation undertakings of all time began operation. On that date the first of a series of the world's largest pumps began lifting water higher than a 47-story building to flow into the dry ice-age channel of the Grand Coulee, ultimately to irrigate more than a million acres of now arid land.

Full effects of this operation will not be felt at once, of course. By the spring of 1952 it is expected that approximately 87,000 acres of land in the Columbia Basin project area will be available for irrigation. Ultimately, however, more than 1,029,000 acres—an irrigated area the size of Rhode Island—will be under cultivation. There will be more than 1,000 miles of canals and laterals on the project, and approximately 6 percent of the flow of the Columbia River at Coulee Dam will be diverted to irrigate the now dry land.

Fundamental to this sort of planning is the requirement that no amount of potentially useful river water be permitted to flow wastefully to the sea. It is for this reason that the Federal reclamation program calls for multiple-purpose use of these natural water resources—flood control, silt and sedimentation control, generation of hydroelectric power, preservation of recreational and fish and wildlife resources, and other conservation benefits. Practically all of Reclamation's 274 million dollar construction outlay in 1951 was devoted to this multiple-purpose type of project.

Yet even that horizon, by itself, is not broad enough. The principle must be broadened to embrace entire river systems if we are to reach our objective of the maximum beneficial use of our water resources.

Consequently, comprehensive plans for river-basin development of the natural resources in several regions of the West is now a major feature of the Department's program.

Near the close of the year, a carefully integrated schedule for multiple-purpose development and use of the waters in the Upper Colorado River Basin, consisting of a team of 10 major storage reservoirs and power plants, and 14 participating projects in Wyoming, Utah, Colorado, Arizona, and New Mexico, was completed and referred to those States for approval, prior to submittal to Congress for action.

Construction work on the broad-scale Missouri River Basin project, and particularly on those elements in the work schedule which would quickly provide additional hydroelectric power and farm irrigation water, went forward apace.

Meanwhile, another giant project came into operation in the great Central Valley of California—one more striking example of the kind of planning that is needed if our expanding resources are to keep pace with our expanding needs.

Shortly after the close of the 1951 fiscal year, Sacramento River water from Shasta Dam, the world's second highest, began moving southward into the San Joaquin River Valley, to effectuate a 500-mile transfer of irrigation water supplies for the region's fabulously productive farming area. This is the longest mass movement of irrigation water ever attempted. It has already added 454,000 kilowatts to the Nation's installed power-generating capacity, and it is now beginning to stabilize and to expand irrigation in one of America's richest and most highly developed agricultural and industrial areas. Full operation of these works, when completed, will provide water for 500,000 acres of irrigated lands now inadequately supplied. Water will also be available to bring another 500,000 acres of dry land under irrigation.

The vast benefits arising from such projects emphasize the soundness of the warning—"make no little plans." We have the resources of soil and water to meet our expanding needs, if we have the intelligence and the energy to develop them properly. It might be pointed out that during fiscal year 1951 nearly 5½ million acres of land in the 17 Western States were furnished with either new or supplemental supplies of water, and the approximately 100,000 full-time or part-time farms provided with irrigation water by the 62 Federal reclamation projects or divisions thereof now constitute an important element in the Nation's agricultural economy. It should be emphasized that revenue to the Federal Treasury from the sale by the Bureau of Reclamation of electric power developed by Government plants came to approximately 37 million dollars during the year, an increase of about 4 million dollars over the previous year's revenue.

Water is a resource important not only to agriculture, however, but to industry as well. Here again we have a resource which until comparatively recently was taken for granted, but which we have been using so heavily that we cannot afford to take it for granted any longer.

The Nation's industry requires far more water than is generally realized. It takes about 270 tons of water, for instance, to make a ton of highly finished steel, 1,300 tons of water to make a ton of aluminum, 2,500 tons of water to make a ton of synthetic rubber, 200 tons of water to make a ton of smokeless powder, and 24 gallons of water to refine a gallon of aviation gasoline.

During the last war, the Geological Survey supplied more than 13,000 reports on the availability of water for the war program, many of them based on rapid investigations made for the immediate purpose of the report and usable in an emergency on a calculated-risk basis. Similar studies can and probably will be made in the present emergency. However, the water available at any location usually varies so much from time to time that the dependable long-term supply can be determined only after many years of collecting information. Records exist for numerous places throughout the Nation, but the apparently insatiable demand for water has made it imperative that the program of collecting water information be stepped up.

Recent history, moreover, has changed the pattern of thinking. All water records that have been kept over a period long enough to be satisfactory were begun at a time when the expected course of national development was quite different from what it appears to be now. The new problems of the dispersal of industry in an atomic age, with relation not only to atomic bombs but also to the disposal of radioactive wastes from atomic materials used commercially, mean new water supply problems. Programs must be planned and carried out in keeping with current trends.

ELECTRIC POWER

An adequate supply of electric power lies at the very heart of the defense program. Any reduction in the supply of materials and equipment needed by the electric power industry will directly and immediately threaten the success of the whole defense production effort. In addition, if the living standards of the American people are not to be impaired by the defense effort there must be provision to meet the normal expansion in our economy's requirement for electric power—an expansion which takes place, year in and year out, wholly aside from the defense production program.

The Defense Electric Power Administration is undertaking to mobilize the Nation's electric utilities for the emergency effort. It coordinates the activities of 4,000 private and public electric power utilities, including rural cooperatives, having a total approximate worth of more than $25 billion.

In its effort to analyze and formulate the Nation's electric power expansion program, and to provide material and equipment to keep that program on schedule, this Administration has called for an increase of approximately 27 million kilowatts of electric energy by the end of 1953. Of that total, it is expected that 2,811,000 kilowatts will be installed in Federal projects, which at present have under construction some 3,800,000 kilowatts of generator capacity.

It needs to be emphasized that this 27 million kilowatt program is a bedrock program drawn up to meet actual defense program requirements. It is not keyed to the normal expansion in the country's requirement for electric power, which goes on rising year by year without reference to the present emergency. It is solely a program to enable us to meet our immediate defense production requirements.

What this means is that even though that program be met in full, our economy could nevertheless come out of the emergency period badly handicapped for lack of adequate power facilities.

This danger bears with particular weight on the economy of the Western United States, where the expansion and strengthening of the economy is peculiarly dependent on full-scale development of western water resources. The extent to which the West can grow food and fiber and maintain industrial production depends squarely on the extent to which projects for irrigation, hydroelectric power, municipal and industrial water, flood control, and other multiple-purpose benefits of our great river systems are developed.

Ever since the end of the last war, the Bureau of Reclamation has been racing against time to catch up with the phenomenal growth of western population and industry, which have sorely strained developed water resources. The expanding defense program simply creates a greater urgency.

At the present time, we are not yet meeting demands for water and power anywhere in the West, despite rapid progress with Reclamation development.

In the Pacific Northwest specifically, it needs to be borne in mind that development of the area's rich mineral and forest resources depends almost entirely on present supply and future potential supply of hydroelectric power. Coal and fuel oil are inadequate to support any substantial industrial development there. Natural gas from Canadian sources has not yet reached the Northwest, and wood wastes, formerly available as a fuel supply, are rapidly finding new and more profitable uses as fabricated wood-waste products. The industrial economy of the entire region, therefore, rests upon its vast undeveloped hydroelectric power resources. The Pacific Northwest possesses 40 percent of the total potential hydroelectric power in the United States, and its resource development will be increasingly dependent upon this type of energy.

During the last war the supreme importance of low-cost power in the development of light metal industries was strikingly demonstrated in the Northwest. Production of aluminum requires electric energy on a scale that 20 years ago would have seemed beyond comprehension. Because of the production of huge blocks of power at Bonneville and Grand Coulee, the Northwest was able to develop a huge primary aluminum industry. In 1939, it produced none of this metal; today, thanks to low-cost power, it produces 45 percent of the primary aluminum produced in the United States. During fiscal year 1951, Bonneville Power Administration supplied directly 6,545 million kilowatt-hours to the aluminum reduction and aluminum fabrication industries. This represents 90 percent of the industrial energy served directly by Bonneville.

In addition, the Administration serves other important industries which require large blocks of low-cost power. These include plants producing calcium carbide and the ferroalloys. The Hanford Atomic Energy Works at Richland, Wash., is also dependent upon Bonneville Power Administration for large blocks of power. All in all, by the spring of 1951 Bonneville supplied more than a million kilowatts to industries.

It is worth noting that essential defense industries in the Northwest rely heavily on what is called interruptible power—power which is available whenever water runoff exceeds a minimum year runoff. When minimum water conditions occur, of course, as they did in 1951, this power vanishes. Nevertheless, during a great part of the time it provides important defense production. As an example, 11 percent of the Nation's primary aluminum production is produced with interruptible power.

Also noteworthy is the fact that the installation of stop logs at Bonneville Dam to raise the height of the pool from 72 to 78 feet added approximately 40 million kilowatt-hours of power to the system. To translate this into concrete terms, this is the equivalent of a 2½ percent increase in United States aluminum capacity.

For the long-range defense program, the Pacific Northwest can increase its industrial capacity, in those industries which use large amounts of electric power, by 300 percent if power is made available by 1959. Long-range possibilities for this area include the following:

Industry:	Percent increase (1951 to 1959)
Aluminum reduction	116
Aluminum fabrication	177
Calcium carbide and ferroalloys	523
Chlorates, perchlorates, and caustic soda	492
Abrasives	622

In addition, alumina, magnesium, elemental phosphorous and titanium can be expected to emerge as new industries in the area. A magnesium plant and an elemental phosphorus plant will be in operation by the fall of 1951. The titanium and alumina plants probably will not be build before 1954.

To achieve such an industrial expansion, additional hydroelectric capacity will be needed. The present January peaking capability (based on median-month water conditions) of the Bonneville system is 2,321,000 kilowatts. The short-range program to 1954 requires an increase of 690,000 kilowatts, while the long-range program would require an addition of 5,621,000 kilowatts to the January peaking capability by 1959. This program includes 10 dams constructed or under construction and 9 additional dams proposed for construction in the Columbia River System.

All in all, the Department today is marketing power from plants in the western States totaling about 4,600,000 kilowatts—about 26 percent of the installed capacity of all hydroelectric plants in the United States and nearly 7 percent of the total installed capacity for all types of plants in the Nation.

Power production on Federal Reclamation projects set new all-time high records during the year. More than 771,000 additional kilowatts of generating capacity were installed in project power plants during the 1951 fiscal year, among them being four more of the giant 108,000-kilowatt generators at the Coulee Dam plant on the Columbia River. During the year, Coulee Dam generators turned out more than 12 billion kilowatt-hours of energy—the largest single hydroelectric producing plant in the world.

The installation of five 45,000-kilowatt generators at Davis Dam on the Colorado River between Arizona and Nevada provided 225,000 kilowatts for this new plant in 1951, while the Estes hydroelectric plant on the Colorado-Big Thompson project in Colorado was provided with 45,000 kilowatts of generating capacity for the power-short industries, communities, and farms in that area. During the year, installation of 24,000 kilowatts of generator capacity was added in the Kortes Dam plant on the North Platte River in Wyoming, bringing that plant's total to 36,000 kilowatts. Kortes was the first power plant authorized as part of the Missouri River Basin project to go into production. The Anderson Ranch project, Idaho, aggregating 27,000 kilowatts, was also added during the year.

Thus in order to provide the power urgently needed in the Defense program, construction of new Federal plants by the Bureau of Reclamation went forward under forced schedule in 1951.

Much progress also was made during the year in solving the problem of distribution of electrical energy.

In some Western States, power is transported over the Reclamation Bureau's 4,520-mile network of Government-built and owned transmission lines. In other sections, where Federal lines have not yet been provided, private utilities have entered into "wheeling agreements" under which the private companies carry federally produced power to Government preference customers over their own lines. In turn, most of the agreements provide that the private companies may augment their own production with power from Federal plants, if desired. Approximately 40 such wheeling contracts between the Government and private utility companies are now in operation, 7 of the more important having been negotiated during the 1951 fiscal year.

This integration of power sources and systems wherever feasible brings an economy and a flexibility in serving power and energy to essential industries and increases the efficiency of the Nation's productive plant. The plan not only effects economies for the ultimate consumer, but also readily adapts itself to the defense program and permits delivery of large blocks of power almost overnight to any production center which needs a new and relatively large source of electric power.

The Southwestern Power Administration is selling the power from three multiple-purpose dams, two of which are connected by a high-voltage transmission line. Two important new projects will be tied to this transmission grid in 1952 and a third in 1953. Although this main line totals only about 500 miles, plans for integration with other power systems will permit the movement of the new power to practically any part of an area which, at its longest and widest, is roughly 1,000 miles by 1,000 miles.

This integration of power sources becomes increasingly valuable in a time of emergency, when productive capacity and supplies of raw materials and finished products must be expanded swiftly for an emergency whose duration cannot be foretold. Under this system the power supplies of an entire area can work together in planning to meet the area's needs for electric energy. The Department is committed to a program of encouraging the most widespread use of Federal power through close arrangements with rural electric cooperatives. Ultimate goal of the Department of the Interior is to make electricity available to every rural resident, with assurance that the supply will be available 24 hours every day. This program assumes especial importance in a time of manpower shortage, like the present.

Equally important is the policy of granting preference in the sale of power to public bodies, including municipalities which own their own generating or distribution facilities. Many of these cities were unable during the last war to obtain generating equipment to supply the needs of their expanding economies, and they are able to contribute more to business and manufacturing concerns because of the Department's marketing program. This is particularly important because the Nation's economy as a whole will be the gainer if the rich deposits of minerals in the southwestern area, for instance, can be processed in the region where they are mined.

In the Southeast, the Southeastern Power Administration recently completed its first full year of operations with substantial contributions of power to defense establishments of the 10 Southeastern States. This power comes from generation at Allatoona hydroelectric plant on Etowah River, in northern Georgia, the output of which is sold to Georgia Power Co., and the generation at the Dale Hollow and Center Hill projects in the Cumberland River Basin, the output of which is marketed by the Tennessee Valley Authority. The Wolf Creek project is scheduled for initial power production during the fall of 1951.

A temporary rule curve was recently put in operation at Allatoona which raised the top elevation of the power pool several feet for further storage of water during the summer months, the effect of which is to store water valued at several million kilowatt-hours, primarily to be used by TVA in Tennessee during the fall and early winter peaks of atomic energy plants. Southeastern Power Administration is working with TVA and the Corps of Engineers for a similar raising of power pools at Dale Hollow, Center Hill, and Wolf Creek Dams in the Cumberland River Basin as an additional source of energy for TVA toward meeting the fall and winter peak loads. The raising of these power pools emphasizes the critical and expanding need for additional power and energy in the Southeast, where defense needs may bring about a curtailment of the civilian power requirement. From Federal Power Commission studies it is evident that generating plants now scheduled will not be able to provide the accepted 15 percent margin in reserve capacity until 1953, which means that additional power is greatly needed to meet the load and to provide adequate reserve capacity.

During the fiscal year 1951, the agencies above mentioned—Bureau of Reclamation, Bonneville Power Administration, Southwestern Power Administration, and Southeastern Power Administration—marketed 24,764 million kilowatt-hours of electricity, produced by plants having an installed generator capacity of 4,910,000 kilowatts, for which about 67.5 million dollars was received in revenues at an average price of 2.72 mills per kilowatt-hour sold. In marketing this power, the Department continued to carry out congressional policies (1) to give preference to public bodies and cooperatives and to prevent monopolization, and (2) to sell power at the lowest possible rates which are consistent with sound business principles and which will return the investment plus interest and assure the widest possible use.

FUELS

One of the most fundamental of our natural resources is fuel. It is the source of the greater part of the energy that activates our industry, keeps public and private transportation systems moving, heats our homes, and cooks our food. Thus far we have met all of the demands which our expanding economy and the immense defense program have put upon our supply of solid and liquid fuels, but it is imperative that we make every effort to insure ourselves of adequate supplies for the future.

America is fortunate in the richness of its endowment in these resources. Even if we no longer talk glibly about inexhaustible supplies of coal, oil, and gas, we still have very great reserves and the principal problem to date has been to mobilize them properly so as to meet increased demands.

We have now reached the point, however, at which we must carefully program the development of our fuels to make certain that we shall always be able to have enough. Every year our consumption is greater than the year before, and it seems probable that that condition will continue indefinitely. Our reserves may be adequate to meet any imaginable needs for centuries to come, but only if we prepare to make the proper use of them. If we simply coast along, we shall very quickly find ourselves severely pinched.

Coal generates about half of our electricity and supplies about 42 percent of our total demand for energy. Industries which are rapidly expanding because of defense requirements are heavily dependent upon adequate and steadily increasing supplies of coal. Steel cannot be produced without coking coal; and in addition, the coking process supplies the basic materials for more than 200,000 chemical products which are vital both in war and in peace, ranging from dyes and solvents to explosives and plastics. Enormous tonnages of coal are used in many types of military production. To make a 1-ton bomb, for instance, requires the equivalent of 2 tons of coal. Making a modern tank requires the power equivalent of 225 tons of coal.

In cooperation with other Government agencies and the coal-mining industry, the Defense Solid Fuels Administration is working to solve problems created by the rearmament program and to prevent the development of shortages in solid fuels. In an emergency period any number of factors, ranging from transportation bottlenecks to shortages of equipment and manpower, may disrupt the flow of coal to consumers, and the Defense Solid Fuel Administration has focused attention on these immediate problems.

During the first 6 months of 1951, bituminous-coal production totaled nearly 266 million tons, an increase of 13 percent over production during the same period in 1950. In the 1952 fiscal year the production of bituminous coal is expected to rise significantly. There will probably also be a rise in the output of Pennsylvania anthracite, used principally for space heating in the Northeastern United States and Canada.

Expansion of the steel industry will put especially heavy demands on our output of metallurgical coal, and the demand for coke will be particularly pressing. New coke ovens with a capacity of close to 11 million tons will come into production by the end of 1952, but since some 6 million tons will be required for replacement purposes this will mean a net additional capacity of only about 5 million tons, and DSFA is attempting to stimulate new coke-oven construction. The Bureau of Mines investigation of coking coal reserves is showing the amount and quality of recoverable reserves of coking coal in the eastern Appalachian coal fields that can be developed to supply heavy demands for metallurgical coals.

A coal-transportation shortage is expected to develop during the winter of 1951–52, and the supply of coal-carrying railroad cars during that winter is not expected to meet the needs. To cope with this problem, DSFA is working with other Government agencies, with the railroads and with coal producers, in an effort to reduce car turn-around time, to keep bad-order cars at the lowest possible minimum, and to increase production of new cars. The DSFA has also supported a summer fuel-buying program and voluntary fuel stockpiling by consumers. No widespread fuel shortages are expected in the winter, although the full cooperation of the coal and railroad industries and individual consumers will be needed if spot shortages are to be prevented.

The pressure on petroleum and natural gas supplies will be even greater than that on coal. The demand for petroleum and its products has increased from a daily average of 3,981,000 barrels in 1940 to 6,803,000 in 1950, with an estimated daily demand of 7,439,000 barrels in 1951.

Those figures do not tell the full story, however. Until comparatively recently, the United States produced more petroleum than it consumed, and as recently as 1940 our annual net exports of petroleum and its products came to more than 46 million barrels. In 1950, we had net imports of more than 198 million barrels. Our petroleum imports last year amounted to about 17 percent of the total world oil produced outside of this country.

Because we have become so dependent on petroleum and gas, the question of assuring an adequate supply is one of the greatest responsibilities of the Government and of the petroleum and gas industry. To assure such supplies, the Petroleum Administration for Defense was set up in the Department of the Interior in October 1950.

In addition, both the Bureau of Mines and the Geological Survey have been hard at work on the problem of augmenting our supplies of oil.

From the Geological Survey come data needed in exploring for new supplies of oil and natural gas. In northwestern Colorado and in Utah, the Survey continues to map rich oil-shale deposits which represent one of our greatest potential sources of liquid fuel. In western Texas, where large oil and gas reserves have recently been discovered, investigation of the occurrence and distribution of reefs in the oil-bearing rocks has been started under the sponsorship of the Petroleum Administration for Defense. In the Eastern United States, studies of gas producing sands have been made which will help to guide further exploration for gas in a highly industrialized region.

It should be emphasized that private industry depends largely on the Geological Survey for data on which to base exploration programs, and that an effective search for new deposits will require accelerated research and geological mapping. Many productive districts have not yet been adequately studied.

Of the 450,000 producing oil wells in the United States (on January 1, 1950) some 70 percent were "stripper wells" that produced an average of only 3 barrels of oil per day. All other wells averaged 30 barrels a day. After these stripper wells have reached their economic limit of production by present methods and at current prices, a large proportion of the oil will remain in the ground. The Bureau of Mines is conducting fundamental research to learn more about the forces which hold this unrecovered oil in the ground, and it cooperates with industry to find ways to increase ultimate recovery. In addition, the Bureau fosters secondary recovery operations which even under present methods assure an additional 3 to 3½ billion barrels of oil in the United States.

An important part of the task of conserving petroleum supplies comes in connection with refining. Much research on the chemistry, physics, and thermodynamics of petroleum is necessary in order that better refining processes may be developed, and in order that better engines may be designed. At the same time changes in petroleum economics must be studied, especially since the United States is increasingly dependent on oil produced abroad, and it is necessary to have more current information on all phases of the industry abroad. Data provided by the Department of the Interior provide the basis from which all Government agencies must develop policies concerning petroleum.

Impressive as the growth of the petroleum industry may be, it has been far outstripped by the rate of the growth in the use of natural gas. Marketed production of gas rose from 2,660 billion cubic feet in 1940 to 6,198 billion cubic feet in 1950—an increase of 131 percent. Even this rate was restricted by pipeline capacity, for demand exists for a much greater volume. Since the Second World War, this fuel has been brought in increasing quantity to the Central and Eastern States, where it is largely displacing manufactured gas.

Proved reserves of natural gas at the end of 1940 were estimated at 80 trillion cubic feet. At the end of 1950, this estimate had increased to 185.6 trillion cubic feet, and marketed production during that period came to slightly more than 42 trillion cubic feet.

These figures represent just one phase of the ever-increasing demand for energy by American industry, and they help to point up the fact that in the midst of this defense program we cannot simply sit back and rely complacently on what we now know our natural resources to be. Those resources are immense, but we are using them up at an ever accelerating rate, and they are literally irreplaceable. And when we have done all that we can do in the way of finding new reserves, perfecting our means of getting these resources out of the ground and finding more efficient ways to use them after they have been extracted, it remains true that we must still take very serious thought for possible shortages in the very near future.

In this connection the development of synthetic liquid fuels offers a great opportunity.

At some time in the future—whether it be in 5 years or in 25—we are likely to find that our steadily increasing demand for oil products is outrunning our domestic supply. It is, of course, true that we can continue for some time to increase our domestic production, provided that steel is available to permit drilling at an increased rate. Nevertheless, we shall eventually find ourselves under considerable pressure to make supply equal demand, and when that day comes it will be necessary for us to place some reliance on a large-scale domestic synthetic fuel industry based on coal or oil shale.

Fortunately, it appears that the possibilities in that field are immense.

Enough technical and engineering data are now available to provide a sound basis for proceeding with commercial development of synthetic-fuel plants. Enough of the raw materials—coal and oil shale—exists to meet all oil requirements for many years. Besides providing a dependable source of gasoline and diesel fuel, these resources could yield much needed supplies of benzene and other critical aromatic chemicals used in manufacturing explosives, synthetic rubber, and other important defense materials.

The coal-hydrogenation demonstration plant of the Bureau of Mines at Louisiana, Mo., has produced thousands of gallons of high-octane gasoline which has successfully undergone severe performance tests, as has diesel fuel produced in the Bureau's oil-shale demonstration plant at Rifle, Colo.

The cost of mining oil shale has been reduced, and an improved continuous vertical retort has successfully passed pilot-plant tests. It is possible to produce completely refined, marketable products from crude shale oil, and oil shale yields many scarce and useful chemicals. Revised estimates of oil shale reserves in Colorado have raised the total figure of contained shale oil to nearly 500 billion barrels, and tests of known areas of Wyoming may double this figure.

Additional research on the production of oil from coal should further reduce costs. At the request of the Department of the Interior a survey of the synthetic liquid fuel potential of each State has been made by the Army Corps of Engineers, and preliminary reports show that many areas possess the required raw materials to support a domestic liquid fuels industry.

It must be emphasized that the time is now at hand when we must begin to move into commercial production of these synthetic fuels. It is not possible to increase oil refining capacity overnight, and by the same token it takes time to build synthetic liquid-fuel plants. It is now highly desirable that commercial synthetic fuels plants be started to bridge the gap between industry and the research and demonstration plant work already done by the Bureau of Mines.

We do not need to worry about our fuel supply in this country, if we continue vigorously to develop our resources in the midst of this emergency. If we fail to do so we shall eventally find ourselves severely pinched, as mounting demands press harder and harder upon presently available sources. The reserves are there, but they cannot be brought into production overnight.

SCENIC, HISTORICAL, AND RECREATIONAL RESOURCES

A time of emergency like the present gives to the resources of our National Park System an unusual value—and places them under an unusual strain.

The need for places which, like these National Park areas, can provide relief from physical, mental, and spiritual pressures is greatly heightened during times of emergency. It is then that these great recreational areas, scenic attractions, and historic shrines most strengthen love of country, respect for our democratic institutions, and determination to defend the rights and liberties which are part of our American heritage.

Yet it is precisely at such times that demands are made upon our parks which, if met, would use up their resources. Furthermore, the emphasis which we put upon national defense and our insistence that we devote our money and effort to strictly essential activities is likely to starve the park system so that it cannot be maintained properly for future usefulness.

Early this year, under authority voted by Congress, the Independence National Historical Park project came into existence, when the Secretary of the Interior formally accepted from the city of Philadelphia the custody of Independence Hall and the associated buildings in Independence Square. Responsibility for preserving and displaying these history-laden structures now rests with the National Park Service. One needs but briefly to observe the interest and reverence of visitors in the presence of the Liberty Bell, for example, to know that such places exert a profound, far-reaching and infinitely beneficial effect upon the American people.

The Department has felt fully justified in recommending for the National Park Service a budget which would permit it to provide both protection and service on a satisfactory scale. All areas should be so maintained and staffed that they could meet national needs. This is not the time to subject the park system to another period of starvation, as was the case during World War II.

We need always to keep in mind the phrase that was so wisely embodied in the 1916 act which established the National Park Service—"to leave them unimpaired for the enjoyment of future generations." There might, of course, be times when supreme national need would compel us to invade the parks to remove some resource which the Nation simply had to have for its defense—something which could not be obtained elsewhere. During the Second World War there were two instances of that kind—one for the removal of salt from Death Valley National Monument, and another for the removal of a single tungsten deposit in a remote part of Yosemite National Park.

However, by the exertion of effort to uncover alternative sources, it was possible to ward off many other requests, and the National Park system came through the war with relatively little impairment except that which was due to inadequate protection and maintenance. The same necessity for preserving the parks exists today. It should be noted that in this effort to safeguard the parks the work of other agencies, such as the Geological Survey and the Bureau of Mines, is of great importance in seeking and finding outside the parks the resources which are needed for the defense effort.

For the past 5 years, each year has seen a new record total of visitors to the 180 areas administered by the National Park Service. Unless the needs of defense make restrictions on travel necessary, it is to be expected that the number of visitors this year will exceed all previous totals. That means more wear on the roads, which must be maintained for comfort and safety; greater demands on camping facilities, where a high standard of sanitation is particularly essential, as well as some extension of the facilities themselves, where the demand justifies it. It means an added load upon the interpretive facilities and interpretive personnel which add so greatly to the visitors' enjoyment of a park visit.

The Department earnestly desires that the areas in the National Park system again contribute to the constructive use of leisure time by members of the Armed Forces. During World War II, more than 8 million persons in the uniforms of the Army, the Navy, and the Marine Corps visited the parks and monuments, all fees being waived for them. Now, with increasing growth of the military, air, and sea forces, the Service is trying to bring to the attention of all servicemen the varied opportunities for enjoyable and constructive use of leisure time which these areas offer. Following a meeting last May between National Park Service officials and representatives of the Armed Forces, all commands will be given full information as to areas within easy reach of their forces and what kinds of recreation may be found there, and are encouraged to bring this information to the men and women of the commands. All superintendents have been instructed to explore fully the ways in which the areas in their charge may be used most effectively.

In the last war the Park system saw the introduction of other uses more directly concerned with national defense, such as overnight bivouacking by military organizations on training trips, and special training such as that provided for ski and mountain troops in Mount Rainier National Park. As yet there have been comparatively few requests for permits for such uses, but there will probably be more. The Service proposes to allow and encourage them, whenever this can be done without damage and without material interference with use and enjoyment by the general public.

There may be a few cases in which it may be necessary to discontinue or restrict ordinary public use in order to permit needed use by the Armed Forces which cannot be supplied satisfactorily or economically elsewhere. That, too, the Service is prepared to do, but only after the fullest exploration and investigation of alternative sites.

Both the present and the future have claims upon these priceless possessions of the American people, and neither type of claim should be slighted or forgotten. We will use these resources for the purposes they best serve, and get the full portion of benefit they offer in this time of emergency, and they will be just as good when we get over this period as they were before. They will continue to serve the people of the future as they were intended to do.

The great scenic and historic places of the National Park system are living symbols of the things Americans cherish. Whether it be Abraham Lincoln's humble birthplace, the abyss of Grand Canyon, the monumented hills and valleys of Gettysburg battlefield or the incomparable valley of the Yosemite—these are scenes familiar to every American; they are sources of relaxation, refreshment, and inspiration. In times of emergency, when the spirit is troubled, these areas take on added importance and many of them become focal centers for patriotic and morale-building activity.

Through such commemorative observances as that which, at Independence Hall, is to point up the one hundred and seventy-fifth anniversary of the Declaration of Independence; through special visits by organized groups; through civic ceremonies, as well as their normal visitor use, both the natural and the historic areas scattered across the Nation must contribute mightily to the understanding and strengthening of the basic historical purpose of the republic.

We have no desire in our country to disown our past and to adopt a totally different political philosophy. Thus each national landmark which is preserved and protected strengthens and reaffirms the citizen's loyalty to our past and his determination to move forward to a future rooted in our national traditions and aspirations.

TERRITORIES

The basic contribution which our Territories have to offer for the defense and strengthening of the United States is a matter of human resources. Along with these, however, it must be remembered that the purely physical resources of such Territories as Hawaii and

Alaska are particularly significant to our current and long-range national security programs. Properly developed, both the human and the physical resources will be of inestimable value. Whether or not that proper development takes place is entirely up to us.

In partnership with Territorial governments scattered over half of the globe, the Office of Territories is working to extend the area of freedom by encouraging self-government and the expansion of free economic enterprise.

It must be emphasized that although geography itself has marked several of our Territories and island outposts as bastions for defense, the real effectiveness of the defense comes down eventually to a matter of the loyal cooperation of every American—of all races, of all colors, and of all creeds. In the Territories we must demonstrate to the world that such cooperation is given with much more enthusiasm and is used with much more effectiveness when it is based solidly on American concepts of political freedom.

Communism can be best opposed by establishing in our Territories conditions of political, economic, and social freedom under which acute and enduring discontents cannot develop.

In the fall of 1950 a subcommittee of the Senate Armed Services Committee sent a task force to Alaska to study defense activities. In its report, this task force remarked that "the easiest country to defend is one in which there is a fairly large population on a sound economic program." To this should be added that the existence of a stable and economically sound population under the American flag depends upon the growth of free and democratic institutions—upon the right of the governed to control their government.

Consequently, one of the major points in the attempt to make the best use of our Territorial resources must consist of the program to provide statehood for Alaska and Hawaii, the two Territories which are most fully prepared for that step.

In the case of Alaska, it is obvious that statehood would promote a healthy feeling of local pride and self-confidence and would help to increase the stable permanent population of this northern outpost —a development which the military greatly desires.

In Hawaii the people are in every way qualified for the full privileges of American citizenship which statehood would confer. Their islands serve as the center for the Pacific operations of the Armed Forces. They have developed industries which are of immediate value to defense, and the casualties suffered by their youth in the Korean War have been far greater than those of any State.

The Secretary of Defense has testified, in regard to statehood for these Territories, that their ability to contribute to defense in case of sudden attack would be greatly increased if they possessed the customary State and local instrumentalities of law and order. He added that locally elected governors, sheriffs, and the locally chosen constabulary and civil defense units would also be of great value in emergency, and concluded that "statehood for Alaska and Hawaii would undoubtedly give a considerable added measure of strength to the over-all defense of both areas in event of emergency."

Statehood for these two Territories would not only provide direct benefits to national defense but would also be an act of simple justice to the peoples immediately concerned. It would also be of substantial value internally by upholding a policy which has won for America the good will and respect of millions of people in colonial and other areas in the Far East.

Aside from the question of statehood, important defense considerations are involved in the Office of Territories' current development programs in Alaska. Land transportation in Alaska is highly important to the Armed Forces, and the vast military construction program there would not have been possible without the work done by the Alaska Railroad and the Alaska Road Commission. The railroad has been rehabilitated and is now meeting transportation demands well above the peak traffic loads of World War II, while essential defense highways in the Territory have been constructed by the Road Commission. The territorial section of the Alaska Highway is now a high standard paved road, except for a 90-mile stretch from Tok Junction to the Canadian border, and the Richardson highway has been about half paved.

In the Caribbean, manpower reserves are highly important. The government of Puerto Rico has developed a program of manpower recruitment and transportation to help meet labor shortages in mainland industry and agriculture. Puerto Rican workers have proven highly successful and have been employed in substantial numbers in agricultural work in the northeastern and east-central parts of the continental United States, as well as in industry. The insular government has also worked with the Armed Services and with private industry in surveying the island's industrial potential.

In the Virgin Islands the increased production of sugarcane, under the program of the Virgin Islands Corporation, has helped to meet the greatly increased demand for sugar on the mainland. The islands have also embarked upon a food-production program calculated to decrease dependence on continental food supplies during the defense period. Human resources on these islands will be strengthened by a public-works program which is concerned with improving health and raising educational levels.

During the year, significant developments took place in our island Territory in the Pacific.

On August 1, 1950, Congress enacted organic legislation for the Territory of Guam, granting the people of that island United States citizenship, a bill of rights, local powers of self-government through an elected legislature, and an independent judiciary, and defined the powers to the appointed governor. On the same day, by executive order of the President, civilian administration under the Department of the Interior was established, ending more than 50 years of naval administration. These measures were strongly desired by the Guamanians, who had been dissatisfied with their former restricted status as nationals.

Civilian government under organic law has developed a new spirit among them. They are meeting their enlarged responsibilities and are displaying pride and confidence in their equal status as citizens. This demonstration of enlightened territorial administration at the doorway to Asia contributes to the international prestige of the United States, and while much remains to be done a sound foundation has been laid for the future.

In further fulfillment of the President's civil-rights program, the Office of Territories, with the cooperation of the Navy Department, carried out plans for the transfer of American Samoa and the Trust Territories of the Pacific Islands, effective July 1, 1951. The Navy Department had administered American Samoa since 1900 and the Trust Territory since its establishment under United States jurisdiction following World War II. This transfer to civilian rule provides a sound basis for the development of self-government in these areas.

The Department's program for this island is based on the principle that the interests of the inhabitants are paramount, subject only to security considerations. The establishment of civilian administration is only a first step in this program. Organic legislation has been drafted for each territory and its enactment will be pressed. While the resources of these islands cannot contribute significantly to the national defense effort, their development will increase the islands' self-sufficiency and will reduce their dependence upon the United States.

FISH AND WILDLIFE

Today we face an increased demand for use of all of our natural resources. This applies as emphatically to fish and wildlife as it does to all other resources; there is a recurring pressure to make unwarranted cuts in our stocks of fish and wildlife, to relax the standards necessary for their protection, and to take untried short-cuts to management.

It is also true that self-interested groups occasionally use an emergency situation like the present to advance projects for exploitation of some natural resource not actually associated with critical need.

Consequently the responsibilities of such agencies as the Fish and Wildlife Service are greatly increased during a period of national emergency. Both the organization and its program must be vigorously maintained if we are to get both the maximum usefulness of these resources and assurance that we do not needlessly destroy resources that will be useful in the future.

This Nation's fishery resources are of particular value as a source of food, both in normal times and during the emergency. The fishery resource of the Columbia River system alone is estimated to have a capitalized value of some 500 million dollars, and an annual value of more than 17 million dollars. Because the great dams for power and irrigation which are being constructed on this river system threaten the great salmon runs of the Pacific States, the Fish and Wildlife Service in cooperation with the States of Washington and Oregon has embarked on a program to preserve this fishery. Objectives of the program include stream clearances, abatement of pollution, screening of water diversions, construction of fishways, transplantation of upriver runs to downstream tributaries, expansion of artificial propagation, and the establishment of fish refuges in which conflicting development will not be permitted.

The world supply of canned salmon comes from the fish which spawn in the rivers flowing into the northern Pacific. The greater part of the supply comes from the Alaskan fisheries, and the preservation of this food resource requires continuing vigilance to prevent depletion by unwise exploitation facilitated by advancing techniques.

The Alaska fishing industry—which is the backbone of the Territory's economy—in two world wars has shown its importance in our national structure. It has unfailingly met the demands made upon it, and it is responding to the present emergency as it did in the past. There is no opportunity for further development of the salmon industry except in the use of the huge cannery wastes which are now being dumped into the sea. Exploitation must be curbed rather than expanded, and it is in the still almost untapped ground fisheries of Alaska that further expansion must be looked for. The Territory's thousands of miles of coastal waters contain myriads of flounders, cod, pollack, and rockfishes awaiting the time when they will be needed to augment the Nation's food supply.

Consumer demand for fish and shellfish has been strong during the past year. To facilitate under emergency conditions the production of fishery commodities for defense purposes, the Defense Fisheries Administration has been set up, closely allied with the Fish and Wildlife Service and having, for the most part, the same directorate. This provides unified guidance for the conservation of fishery resources, and production from these resources for defense needs.

On both the Atlantic and Pacific Coasts and in the Gulf of Mexico, exploration of new fishing grounds and experiments with new and improved methods of capturing fish are under way. Exploratory vessels operated by the Service have located new shrimp resources in Alaska and the Gulf. Two projects are under way to determine the abundance and availability of Atlantic tuna and the best methods of catching them. In various ways, the Service is seeking to achieve the goals of increasing production with less cost in time, materials, and manpower.

Management of waters in national parks, forests, and other Federal lands is receiving more attention to provide a habitat for greater poundage of trout to meet increasing sport fishing pressure, and the Service works in close cooperation with the various State conservation departments to attain this end. As population and industry continue to grow, the problem of maintaining game fish in our inland waters becomes more and more complex, and any lag in the effort to maintain this resource will result in depletion of the fishery and perhaps in the extinction of certain fishes.

Many reservoirs, ranging from small farm ponds to large lakes, are being constructed each year, and there is a tremendous demand for pondfish for stocking purposes. The Service is making every effort to meet this demand, and a construction and improvement program at various pondfish hatcheries is under way, and a great poundage of highly nutritious food in the form of warm-water fishes can be produced in the waters of this Nation if these waters are properly stocked and managed.

While this country possesses many useful forms of wildlife it also contains certain species of wild animals which, unless controlled, would seriously reduce our production of food and fibers. Control of these destructive predators and rodents enables American ranchers and farmers to produce from 10 to 20 percent more food and wool than would be otherwise possible. This extra margin of production is of high importance, and the most modern approved methods of predator and rodent control are worked out and applied in an integrated program of States, counties, farm groups, and individuals in cooperation with the Fish and Wildlife Service.

The Service also conducts certain projects primarily to solve military problems. Extensive work is being done at the Patuxent Research Refuge at Laurel, Md., in cooperation with the Office of the Surgeon General, on infectious hepatitis, a malady affecting troops in the Far East. In cooperation with the Office of the Quartermaster General, the Service for years has conducted research on methods of rodent control and the prevention of rodent damage to packages. It is also cooperating in studying points of specification for procurement of fur ruffs for parka hoods, for use in cold climates by the Armed Forces.

Continuing the cooperation established during the last war, parts of many wildlife refuges administered by the Service have again been made available for purposes of natural defense. In the last war, some 2 million acres of refuge lands were used for bombing ranges, artillery ranges, aerial gunnery ranges, chemical and war munitions plants, training grounds, and so on, thus saving the expense of acquiring sites at excessive costs. In many instances these refuges were the only areas found acceptable for use by the military authorities. Then, as now, the Fish and Wildlife Service was responsible for the protection of wildlife on these areas, for the maintenance of facilities, and for protection of the areas from fire, flood, and trespass.

The need for greater production of crops caused the farming of much submarginal land, on which wildlife normally is the most productive resource. Drainage of additional farm lands has been accelerated, resulting in widespread and irreparable damage to the habitat of waterfowl and other kinds of wildlife. Such programs have attempted to reclaim many salt marshes along our coasts, seriously reducing the chief wintering grounds and feeding areas for the major part of the migratory waterfowl stocks of the continent.

Considering all of the pressures which the emergency puts upon our fish and wildlife resources, it is obvious that permanent damage could be done to them unless unremitting vigilance is exercised. A proper care for these resources is one of the elements that make up our boasted American standard of living, and their preservation is essential for the future growth and happiness of this country.

THE AMERICAN INDIAN

American Indians have participated in every war in which the United States has engaged. In World War II, they put 25,000 men into the uniforms of our armed services, fought on all our battle fronts, and won 206 decorations for valor—including 2 Congressional Medals of Honor. Today, they are serving everywhere there are troops—in Korea, in Alaska, in the Marshall Islands, Japan, Okinawa, Guam, and other Pacific islands, in England and in Germany. The tribal roll call of those serving in the Armed Forces would be almost as long as the historical list of our treaties with the Indians.

During the last war the Indians at home had a record that matched that of their fighting men. More than 40,000 left the reservations during each of the war years to take war industry jobs—in ordnance depots, aircraft factories, on railroads, and in other war industries, chiefly in the Western States. They invested more than 17 million dollars of restricted funds in war bonds, and their individual purchases probably amounted to twice that amount.

Today the same story is being told. In the Southwest, in the plains area, in the Northwest, on the West Coast and in other parts of the country, Indians are performing essential jobs—in copper, iron, lead, and zinc mines, on the railroads, in manufacturing plants, in ordnance depots, and on various Armed Forces installations. (It is noteworthy that more than 1,000 Indians are employed at Tinker Field, which is named for General Tinker, an Indian who fell in the battle of Midway.)

The point of all of this is that the Indians have faithfully served America in critical times in the past, and are doing the same thing today. Their human resources are being put at the Nation's disposal, and are being put to work. The same is true of their natural resources, whose potential is being brought up to their maximum sustained productivity so that they can make their rightful contribution to our defense effort.

Indians live in all 48 States and have extensive land holdings in 27 States. Their lands, although greatly diminished during the past century, and lying largely in arid and semiarid regions, are still of great importance to our country. They are a basic economic resource; from them come meat, oil, gas, coal, timber, and other products of value.

Beginning a few years prior to Pearl Harbor, the Indian Service, in cooperation with other Government agencies and the Indian owners of the minerals, turned from the peacetime emphasis upon husbanding natural resources to a policy of more active encouragement of discovery, increased production, and simplified procedure in making available the mineral deposits needed by our war industries—all within the framework of sound conservation principles. This policy has been adhered to.

This has resulted in increased development. During the fiscal year ended June 30, 1950, approximately 2,000 oil and gas leases were approved. More than 20 million barrels of oil were produced from slightly more than 11,000 producing wells on Indian lands. Gas production totaled more than 13 billion cubic feet. On the Osage reservation, where it appears that the peak of production has passed, there is a strong interest in secondary recovery operations.

The approval of the ore commingling plan on the Quapaw reservation and the increased price for ore have served to increase the production of low-grade lead and zinc ores and isolated high-cost ores.

Since the first discovery of petroleum on the Navajo reservation, around 1924, income from oil has totaled more than $3,700,000. During the last fiscal year, Navajo income from sale of oil and gas leases, from annual rentals on existing leases, and from royalties on production came to over $480,000; and from 1942 to 1950 the Navajos' total income from vanadium-uranium leases was more than $170,000. Development of the potential uranium resources on the Navajo reservation has received continuous attention. Cooperation with the Atomic Energy Commission has been marked.

It is expected that the production of other useful materials from Indian reservations—such as tungsten, asbestos, gypsum, and sand and gravel—will increase and will play a part in the Nation's defense program.

For several years it has been Government policy to aid Indians to gain economic self-support through maximum utilization and conservation of Indian resources. This policy has begun to pay dividends to the country as well as to the Indians. During the current fiscal year, 32 Indian reservations had active soil and moisture conservation programs in operation, and both the land and other resources are being managed on a sound conservation basis. Increased production for defense goes hand-in-hand with the protection of Indian natural resources. Indian forest and grazing lands are managed in accordance with the principle of sustained yield. Nearly 582 million board feet of timber were sold from Indian lands in the calendar year 1951, and the number of cattle owned by Indians has increased from about 182,000 in 1932, shortly after the start of the Indian Service's agricultural extension and credit program, to nearly 350,000. Indian income from the sale of livestock and livestock products during that period rose from $1,300,000 to approximately $30,000,000.

Indian contributions to the defense effort in the field of foodstuffs can be visualized when Indian farm production is translated into terms of standard army rations. During the fiscal year 1951, Indian lands produced enough meat—beef, pork, mutton, and poultry—to feed 445,541 soldiers for 1 year; enough cereals for 544,485 soldiers; enough potatoes to feed 15,106 soldiers; enough eggs to feed 58,189 soldiers; enough fresh fruit for 29,739 soldiers, and enough butterfat for 16,184 soldiers. Indians also marketed enough wool to supply all clothing requirements for more than 15,000 soldiers.

Enough has been said to show clearly that the American Indians and their lands represent a rich resource for this country in its time of need. Every effort is being made to enable the tribesmen to make the best possible contribution, for themselves and for their country.

CONCLUSION

The country's resource base is infinitely complex. In one way or another all of its elements are essential to the continued growth and development of this country. Whether we are considering the proper use of our rivers and streams, the development of our minerals, the handling of our fuel supply or the maintenance and use of our national parks and monuments, it is clear that in this time of emergency we simply do not dare to relax our efforts to use these resources with the intelligent forethought which will provide for the future while it also enables us to meet the immense demands of the national emergency.

We have learned a great deal about this problem, in the last few decades, and it is extremely significant that in the fight which the free world is making to maintain itself against totalitarian aggression, and to provide its people with a better life, many other nations are anxious to learn from us the programs and techniques by which we exploit and conserve our natural resources.

Indeed, one of the greatest contributions this country can make to the common cause is to make its knowledge available to the people of other lands.

Perhaps the greatest of our common enemies is simple poverty, which creates the deadly breeding grounds for the kind of discontent which the totalitarians seek to use for their own purposes.

In some lands this poverty exists largely because men do not know how to make the fullest use of their own natural resources. To an ever-increasing extent, those lands are sending their engineers and administrators to us, to see how we manage such resources and to try to transplant that knowledge to their own lands.

To those people our works in the field of reclamation, for example, are an inspiration. Countries which have been irrigating semiarid lands for many centuries, and which still apply the primitive techniques developed in the long ago, are sending people to us to learn how they can make their lands more productive. The body of knowledge which we have—and which we make freely available to others—represents one of the greatest assets of the entire free world. Conservation and sound development of the world's natural resource base must go forward unceasingly if the present great crisis in human affairs is to be surmounted, and we have a position of leadership there simply because we have shown in our own land what immense benefits can be derived in that way.

We need to continue to make our knowledge available, and to show others as best we can how they can increase their own productivity and well-being.

We ourselves need to continue with our own conservation and development programs. It is precisely in this time of emergency that these programs are of the greatest value to us. We could make no more tragic mistake than to let the demands of the emergency period compel us to relax our efforts and use our resources to meet the needs of the immediate moment without regard to the future.

Our greatness, our national strength, the prosperity which to so large a degree we have succeeded in translating into human happiness and human freedom, begin with the base of our God-given resources. We use these resources for defense, as we are supposed to do—and, as we use them, we realize that if we take the proper care and forethought we may preserve them so that we shall always have them. Using them in that way, we do not need to fear any imaginable future.

Oscar L Chapman

Secretary of the Interior.

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Bureau of Reclamation

Michael W. Straus, Commissioner

DESIGN AND CONSTRUCTION

THE OUTBREAK of the Korean War which virtually coincided with the beginning of the fiscal year necessitated cutbacks on the program of the Bureau of Reclamation. The "no new starts" policy of the Administration, with minor exceptions, was continued in effect. Nevertheless, Design and Construction activities continued the sustained pace and effort of postwar years and progressed on previously authorized and financed West-wide undertakings to new high levels of progress and completion. As an exception to the "no new starts" policy, the Congress authorized and financed initiation of construction of the Eklutna project, for power development, in Alaska.

During this fiscal year the Bureau carried out one of the largest volumes of work in its history. About $255,000,000 was added to the nearly 2-billion-dollar Reclamation investment in water resources developments.

Defense-order priorities, material scarcities, rising price levels, and sharply increased power demands combined to add difficulties to the year's operations. However, streamlining of working methods, and cooperation by the regional and field units in matters of project plans, specifications, contract awards, and design delegations helped to keep to schedules. At the same time designs met requirements even when schedules were foreshortened by changes in plans or by expedited program requirements.

More than 850 construction, material, equipment, and supply contracts were awarded for the fiscal year period. These contracts comprised an aggregate total of more than 107 million dollars. Contracts for construction totaled 86 million dollars of this amount, or about 80 percent. Construction contracts in force at the beginning of the year totaled more than 325 million dollars. At the end of the year they totaled nearly 283 million dollars. An additional 2 million dollars worth of work was awarded and completed during the year.

Construction highlights were completion of four dams—Kortes, Bonny, and Dickinson Dams and Superior-Courtland Diversion Dam—on the Missouri River Basin project; North Coulee Dam and Feeder Canal on the Columbia Basin project; Davis Dam on the Davis Dam project; and Estes and Marys Lake Power Plants, and Granby Pumping Plant on the Colorado-Big Thompson project. Of signal interest was the completion of major canal and pumping plant features to the extent that first integrated operation of the Central Valley project was assured during the 1952 fiscal year and that irrigation water to serve the first 87,000 acres of land in the Columbia Basin would flow soon.

Administratively, the branch strengthened its functions and procedural techniques through a critical analysis survey, and instituted several organizational changes for greater efficiency and economy of operations in these areas. Through continued review of its contractual relations and specifications, additional improvements in specifications were adopted, and advance contract information was broadened to attract an increased number of bidders on Bureau work.

Increase of technical assistance to other governments through an expanded foreign activities program during the year made possible the furtherance of international cooperation and enhanced the cause of world progress and understanding.

Through its intensive design and construction accomplishments in conserving and developing the water resources of the Western United States, the Bureau of Reclamation in fiscal year 1951 made a major contribution to the country's effort to mobilize and utilize natural resources during the national emergency.

Contract Awards

Major contracts awarded during the year are summarized in Table 1. Among the features placed under contract for construction were Cachuma Dam on the Cachuma project in California, Flatiron Power and Pumping Plant and Afterbay Dam on the Colorado-Big Thompson project in Colorado, 92 miles of the Angostura Canal on the Missouri River Basin project in South Dakota, more than 380 miles of electrical transmission lines to be integrated in the Transmission Division of the Missouri River Basin project, and 16.5 miles of the East Low Canal on the Columbia Basin project in Washington.

Table 1.—*Major Bureau of Reclamation contracts awarded in fiscal year 1951*

Feature	Project	Amount of award
Cachuma Dam	Cachuma	$6, 722, 520
167 miles Bismarck-Mobridge-Oahe transmission line; 135 miles Fort Randall-Oahe transmission line.	Missouri River Basin	5, 388, 192
Steel penstocks, manifold, concrete penstock structures, Pole Hill power plant and Flatiron power and pumping plant.	Colorado-Big Thompson	4, 284, 512
Towers and appurtenances, Oahe-Fort Randall-Sioux City transmission lines, 256 miles long.	Missouri River Basin	4, 178, 114
16.5 miles East Low Canal, ½ mile Lind Coulee wasteway	Columbia Basin	3, 490, 304
Grand Coulee Dam—River improvements, repair of spillway face and spillway bucket.	do	2, 662, 866
Three generators for Folsom power plant	Central Valley	2, 550, 185
Flatiron power and pumping plant and Afterbay Dam	Colorado-Big Thompson	2, 240, 359
92 miles Angostura Canal	Missouri River Basin	2, 212, 508
Grand Coulee Dam—River channel slope protection	Columbia Basin	2, 199, 800
Earthwork and structures for relocation C B & Q railroad, Trenton Dam.	Missouri River Basin	2, 195, 467
1.8 miles West Canal-Frenchman Hills tunnel	Columbia Basin	2, 175, 315
12.6 miles North Poudre supply canal and diversion dam	Colorado-Big Thompson	1, 955, 187
220 miles Brookings-Watertown-Groton-Huron transmission line.	Missouri River Basin	1, 865, 306
Completion of Hungry Horse Dam power plant, switchyard	Hungry Horse	1, 792, 782
Turbines for units A-3, A-4, A-9, Hoover power plant; construction of electrical equipment, Hoover switchyard.	Boulder Canyon	1, 777, 241
10 miles Mohawk Canal, Tyson protective dike and outlet channel.	Gila	1, 719, 348
Towers and appurtenances, Bismarck-Mobridge-Oahe transmission lines 167 miles long.	Missouri River Basin	1, 694, 562
1.3 miles Bald Mountain pressure tunnel	Colorado-Big Thompson	1, 691, 262
70 miles laterals 124.5 E., 127.7 E., and 130.4 E. and sublaterals, 9 reservoirs, 10 pumping plants, unit 3, Southern San Joaquin Municipal Utility District.	Central Valley	1, 671, 177
Three turbines for Folsom power plant	do	1, 629, 625

Progress of Construction

Construction on Bureau of Reclamation projects during the year continued on the high plane of performance and accomplishment initiated in and exemplified by larger Reclamation programs of the postwar period. The work of the field construction forces continued to be consistent in progress and quality with the performance of the previous year and was matched by progressive advance in the contractors' skill and equipment as well as in supervisory relations. In general, the over-all rate of accomplishment and economy of construction was improved, although economic comparisons were difficult to analyze in view of the sharp change in price trends during the year.

The construction record for the year was notable for completion of several major structures. On the Missouri River Basin project, Kortes Dam and Power Plant, Bonny and Dickinson Dams, and Superior-Courtland Diversion Dams were completed. Bonny Dam was completed more than 1½ years ahead of schedule. Dickinson Dam, scheduled for completion by June 1951, was actually completed in August 1950. Estes and Marys Lake Power Plants, among the principal sources of power for the Colorado-Big Thompson project, and the Granby Pumping Plant, a key project unit, were also completed. The unique transmission cable through the Alva B. Adams Tunnel on the Colorado-Big Thompson project was placed in operation also to serve as the connecting link between the western slope and eastern slope power features of this transmountain diversion development.

On the Central Valley project the last 40 miles of the 153-mile-long Friant-Kern Canal was completed. Sixty miles of the Delta-Mendota Canal were added to the project, and construction on the final reaches was advanced to a point where virtual completion of the 120-mile-long facility was assured early in the following fiscal year. Installation of four additional generators, R–5, R–6, R–7, and R–8, in the Grand Coulee Power Plant on the Columbia Basin project was completed during the year, bringing the total installed nameplate rating capacity of the plant to 1,866,000 kilowatts. The Grand Coulee Pumping Plant structure was essentially completed by the end of the year; the first pump was placed in continuous operation in June, and the second pump was scheduled for operation in July. On the same project, the North Coulee Dam and Feeder Canal, Soap Lake Siphon, and 18 miles of the Winchester Wasteway were completed.

Progress of work on Hungry Horse Dam, largest of Bureau of Reclamation dams now under construction, was maintained on schedule. The millionth cubic yard of concrete was placed in the dam in November 1950, 14 months after placement began. By the end of the year the height of the dam had reached about 300 feet of its full height of 564 feet above the foundation.

On other projects, Davis Dam and Power Plant on the Davis Dam project, Arizona-Nevada, were completed, and all five generators were placed in service by June; Fort Sumner Diversion Dam on the Fort Sumner project in New Mexico was completed, and 15 miles of the Main Canal were added to the project; and the 18-mile-long Wellton-Mohawk Canal was completed on the Gila project.

Construction progress on features remaining under contract reached substantial levels of accomplishment indicating completion in 1952 of such major structures as Boysen, Keyhole, Shadehill, and Cedar Bluff Dams on the Missouri River Basin project, Platoro Dam on the San Luis Valley project, and Big Sandy Dam on the Eden project.

At the close of the year, construction was under way on 13 storage dams, 2 diversion dams, 10 power plants, 6 pumping plants, 360 miles of main canals, 28 miles of tunnels, 2,200 miles of transmission lines, and lateral systems for 17 separate areas.

Principal Features Completed

Principal features completed on Bureau of Reclamation projects are shown in table 2. Included are 7 dams, 5 power plants, 167 miles of main canals, and 1,686 miles of transmission lines.

Table 2.—*Principal features completed on Bureau of Reclamation projects in fiscal year 1951*

Feature	Project	State
Kortes Dam and power plant	Missouri River Basin	Wyoming.
Bonny Dam	do	Colorado.
Dickinson Dam	do	North Dakota.
Superior-Courtland diversion dam	do	Nebraska.
600 miles transmission lines, transmission division	do	North Dakota, Wyoming, Nebraska.
Estes and Marys Lake power plants	Colorado-Big Thompson.	Colorado.
Granby pumping plant	do	Do.
1 mile tunnel No. 1 and 8 miles Horsetooth feeder canal.	do	Do.
125 miles transmission lines	do	Do.
Grand Coulee power plant—Generators R-5, R-6, R-7.	Columbia Basin	Washington.
2.4 miles Soap Lake siphon	do	Do.
North Coulee Dam and feeder canal	do	Do.
18 miles Winchester wasteway	do	Do.
Anderson Ranch spillway and power plant	Boise	Idaho.
40 miles Friant-Kern Canal	Central Valley	California.
60 miles Delta-Mendota Canal	do	Do.
129 miles Shasta-Tracy east side transmission line	do	Do.
97 miles Shasta-Tracy west side transmission line	do	Do.
Davis Dam and power plant	Davis Dam	Arizona, Nevada.
635 miles transmission lines	do	Do.
5 miles Salt Lake aqueduct	Provo River	Utah.
Unit 7, Coachella Valley distribution system	All-American Canal system.	California, Arizona.
18 miles Wellton-Mohawk Canal	Gila	Arizona.
Fort Sumner diversion dam	Fort Sumner	New Mexico.
15 miles Main Canal	do	Do.
26 miles Fire Mountain Canal	Paonia	Colorado.
100 miles transmission lines	Fort Peck	Montana.

Continuing Program

Among the major features expected to be placed under construction on Bureau projects during fiscal year 1952 are 3 power plants, 2 pumping plants, 84 miles of main canals, laterals to serve 260,000 acres of irrigable lands, 370 miles of pipelines for an irrigation distribution system, and over 600 miles of transmission lines.

Major features on Reclamation projects expected to be completed in fiscal year 1952 consist of 6 dams, 5 pumping plants, 160 miles of main canals, over 2,100 miles of transmission lines, and 400 miles of pipelines for an irrigation distribution system.

Alaska Program

Award of a contract this year for materials for a steel warehouse at the Eklutna, Alaska, Government camp was the first Reclamation contract ever awarded for a project located outside the 17 Western States. The Eklutna project, located about 30 miles northeast of Anchorage, Alaska, is designed primarily to make available critically needed power for an important area. It also is to provide irrigation and recreation benefits later. The project includes a 30,000-kilowatt power plant, a low earth dam, a 4½-mile-long concrete-lined diversion tunnel, and a 160,000-acre-foot storage reservoir.

During the year design and specifications preparations were under way for start of construction in fiscal year 1952 for several features of the project. This work was directed toward the following scheduled program: issuance of specifications and award of the construction contract for the power plant structure; award of the contract for construction of the diversion tunnel; issuance of specifications for construction of the Eklutna switchyard; completion of the Palmer substation; completion of the Government camp, warehouse, laboratory, and initial installation of communication equipment, and completion of the Eklutna-Palmer transmission line.

Development of the Eklutna project is an initial step toward realization of a full-grown regional economy. The project is the first stage of a much larger plan for development of water resources in the fast growing areas around Anchorage and in the Matanuska Valley.

Administrative Developments

Over-all staff efficiency and administrative functioning continued to receive close attention and analysis to maintain the degree of design and construction performance necessitated by the year's program and defense requirements.

To appraise staffing requirements and operating practices and to reexamine functions and procedures for the purpose of eliminating nonessential activities and reducing personal services expenditures, a "cost of doing business" survey was conducted throughout the Branch as part of a Bureau-wide survey. As a result of the survey, several procedural and organizational changes were made, making possible greater efficiency and better utilization of personnel. In addition, a number of recommendations relating to design and construction procedures submitted by regional and operating offices were analyzed and improved. A significant result of this phase of the survey was the simplification of technical field reporting requirements.

To improve technical and administrative procedures and uniformity of construction standards, construction engineers were again convened in Denver for the annual Construction Engineers' Conference. During the week-long conference, the problems of contract administration, labor regulations, equipment and machinery installation by contract, and other matters relating to the Bureau's contractual responsibilities were subject to critical review and open discussion. Emphasis this year was placed on construction quality, economy, and concentration of work to speed production of additional hydroelectric power needed for the defense effort. Program participants represented virtually every important Reclamation project in the 17 Western States and the Denver and Washington Offices.

Security conditions at Bureau power plants were carefully investigated during the year.

An outstanding event of the year was the formal dedication at Denver, Colorado, of the Reclamation Enginering Center in July. More than 40,000 visitors toured the offices and laboratories during the open-house program.

Developments in Specifications Requirements

As in previous years, improvement of specifications and contractual administration procedures received continued attention. Although the impact of the national rearmament program did not seriously affect the Bureau's bidding procedures for construction contracts, certain specifications requirements were modified because of shortages and price changes.

Sufficient bids were received for most specifications issued, and quotations for equipment were reasonable under the current market conditions. However, to avoid delay stipulations in bids for heavy electrical and mechanical equipment, it was necessary in some instances to include escalation provisions in specifications. In some of the larger electrical equipment specifications an additional provision covering the right to terminate after a prolonged period of delay was also included. The paragraph for contractor-furnished materials in construction specifications was modified to allow for substitution of specified materials which might not be available because of priorities or scarcities.

During the year lists of prospective bidders and lists of those who have requested copies of the specifications for any work or equipment were removed from a restricted status to make them available at issuing offices for inspection by contractors, suppliers, and other interested parties.

To make specifications clearer, more concise, and more readable new measures were initiated during the year to reduce the context of specifications. Such changes included elimination of detailed materials specifications, instructions for use of special type materials, and certain laboratory procedures. Standard Bureau specifications were made available to bidders and suppliers to cover the requirements for these special materials.

Design Activities and Developments

Design activities continued the trend of the past several years toward increased efficiency and output by closer cooperation with field forces. There was marked increase in the participation of the staff in project planning, site and material inspection, and preparation of preliminary designs and estimates. The design staff was occupied also with review of project plan reports, study of drainage requirements, operation and maintenance liaison work, and inspection of structures. Design work was facilitated by improved program formulation, initiated through group conferences of the program staff with regional representatives.

Following an exhaustive study of the design criteria for concrete dams, recommendations were approved providing for an increase in concrete stresses. By allowing an increase in stresses, significant savings will be possible in certain concrete dams through a reduction of the volume of concrete and requisite foundation excavation. The new criteria for concrete dam design mark an important advance in Bureau engineering practice.

A signal achievement of the engineering staff was solution to the long-continued problem of control of serious vibrations of the large turbine runners in the Parker Power Plant on the California-Arizona border. The vibration, at times a difficult problem in such installations, had caused cracking of some of the turbine blades. As a result of exhaustive tests and measurements taken during turbine operation, a change in the shape in the runner blades was made, eliminating the crack-causing vibrations. In addition, these modifications increased the power output and improved efficiency. Basic data derived from these tests were also valuable in establishing precedents for future designs of large turbines.

The difficult problem of surging (flow fluctuation) in the pipelines of the Coachella Valley Distribution System was also solved during the year. Intensive studies revealed that the surging could be controlled by covering the vertical pipe stands of the system with vented caps. Use of the lids reduced surging to such an extent that delivery of water was made possible from all completed structures.

During the year approximately 50 designers' operating instructions were issued ranging from those to be used in operating a single gate valve to comprehensive criteria for the complex operation of an entire feature such as a dam and power plant. The operating criteria and instructions were initiated in the previous year to assure proper and efficient operation of installed equipment and machinery.

Much work was done also by designers on the development of new designs of overhead vertical lift gates, investigation of dredge stability, and earthquake effects on dams.

Research Activities

Nearly all forms of Reclamation structures and their functioning were under study in the Bureau's research laboratories in Denver.

Studies and investigations progressed and field test sections were installed in conjunction with the development of new and lower cost materials and methods of installation for linings to reduce seepage in irrigation canals. Sections of various membranes, such as those composed of catalytically blown asphalt cement and of prefabricated asphalt backed with paper and reinforced with fiber glass, were installed in canals, and seepage measurements before and following installation of the linings were made.

Research in earth included, aside from a great volume of current soil testing: study of expansive clays, development of field penetration tests for soils, and development of soil classification standards. Some important field tests were also begun. Piles were driven in loessial soils and pile bearing tests were performed, in collaboration with field forces, to determine driving and bearing characteristics for frictional and point-bearing types of piles. The results were used to correlate pile bearing capacity with characteristics of loessial soils. Electrical methods of soil stabilization were also investigated. As a result of these studies, the feasibility of these methods in the field is now determinable in the laboratory.

Geophysical tests, by seismic and electrical resistivity methods, were conducted to determine depths of weathered rock at dam sites. Geophysical techniques were also used in tests to determine adaptability of geophysical equipment for location of aquifers and points of leakage from irrigation canals.

The laboratories continued their studies on "false set" in portland cement (a premature stiffening of the cement in concrete and mortar) and advancements were made in the determination of the causes of this phenomenon. A specification was developed during the year to cover all types of pozzolanic materials in concrete. Previously, detail specifications were available for fly ash (a pozzolan) only.

Prompted by the need for finding economical substitutes for rock materials on earth dams, the Bureau initiated a program of experimental installations of two substitute materials at Bonny reservoir in eastern Colorado. Asphaltic concrete and soil cement were the materials placed as test sections at the reservoir. From this full-scale test program may come the answer to the problem of reducing the cost of construction of earth dams throughout the Great Plains States of the Missouri River Basin. In many plains areas, rock materials are unobtainable locally and must be shipped in from distant sources.

A comprehensive test program on anchorage values of various types of reinforcement bars, including new "high bond" bars, was also completed. Performance of the bars in beams in flexure was tested and many pull-out tests were made. Data from these tests were analyzed and significant information relative to structural action of reinforced concrete was developed.

In metals, continuous records of strains in steel were made by electronic equipment to study the effects of creep, plastic flow, and fatigue.

Tests performed during the year indicated that the techniques used in welding mild steel can be used without modification for welding low-alloy, high-strength steel members.

The substitution of pozzolan for cement confirmed by laboratory testing, together with the adoption of revised criteria for design of large gravity-type dams, has effected substantial economies in the cost of such dams.

To corroborate conclusions reached from previous investigations on Hungry Horse and Canyon Ferry Dams, an extensive testing program was carried out on cores taken from concrete placed last year in the dams. The results substantiated earlier investigations and assured greater reductions in cement and pozzolan content.

International Cooperation

The Branch of Design and Construction, as in past years, played a significant part in carrying out the Bureau's increasing responsibilities in the field of foreign activities. The scope of the participation of this Branch included the loan of personnel for missions abroad, rendering training, design, testing, and related services, taking part in international conferences and, through correspondence and publication exchanges, maintaining the exchange of technical information with engineers of other countries.

Work Performed With and for Other Agencies

In addition to carrying out Reclamation design and construction responsibilities, the staff performed much work for outside agencies. Leading assignment was continued work in the preparation of construction drawings and preparation of specifications for equipment for Falcon Dam and Power Plant, a principal International Boundary and Water Commission structure on the Rio Grande in Texas. Supervision of grouting at Diablo Dam and continued study of structural behavior of Ross Dam for the city of Seattle were also major undertakings.

Much test and research work was performed for outside agencies. Laboratory work on development of heavy, dense concrete for the Atomic Energy Commission continued. Of primary consideration was the selection of a dense aggregate, heavier than that normally used in concrete, and which would produce concrete meeting certain rigid requirements relative to behavior under special service conditions.

The laboratories continued to assist the United States Forest Service in conducting tests on chemicals used in control of beetles in national forests. At the request of the Fish and Wildlife Service, the laboratories gave advice and information concerning the development of an insoluble coating for poisoned grains to be used for rodent control in reforestation projects. Cooperative studies between the Bureau research laboratories and Colorado A & M College were undertaken to improve methods of designing stable unlined channels.

Weed control investigations were also conducted in the laboratories in cooperation with the Department of Agriculture. Progress was made in the radioisotope laboratory in application of radioactive tracer techniques involving use of "tagged atoms." Studies were initiated on the measurement of absorption of radio-active materials as a means for determination of the density and moisture control of soil.

The laboratories continued to act as the acceptance testing agency for the Denver office of the Federal Supply Service in testing of protective coatings and related materials.

Work was also performed for the Navy on the use of construction materials for the Fena River dam site in Guam, for the General Services Administration in remodeling certain buildings of the Denver Federal Center, and for the Northern Arizona Light & Power Co. in analyses of a transmission system by use of the Bureau's network analyzer.

Members of the research staff, representing the Branch of Design and Construction, participated in the concrete conference held during the year with representatives of the Department of Army. Included in the agenda were discussions and interpretations of test results on permeability and of tests on lean mass concrete, and experimental determination of uplift pressures on concrete dams. Bureau designers cooperated with the Corps of Engineers in the design and construction of irrigation features and facilities for flood-control reservoirs at Harlan County and Folsom Dams.

The Bureau's mapping activities, particularly those using aerial photography, were coordinated with the programs of such primary mapping agencies as the Geological Survey, Army Map Service, Coast and Geodetic Survey, and Soil Conservation Service, to insure that no duplication occurred. Contracts for aerial photography and mapping were awarded by the Bureau for areas in California, Colorado, Montana, Nebraska, Wyoming, and Alaska where urgent requirements could not be met by the primary mapping agencies.

In order to meet the Bureau's requirements for special high-dam data, and requirements of the Coast and Geodetic Survey, for the latest and more complete seismic information, coordinative seismological studies of the Bureau, the Coast and Geodetic Survey, and the National Park Service were continued at Hoover, Shasta, and Hungry Horse Dams.

The Bureau continued cooperating with the National Park Service, Smithsonian Institution and various state agencies regarding archeological and paleontological surveys, and excavations at sites where construction was contemplated or in progress.

Cost Trends

At the beginning of the year costs for Bureau of Reclamation construction had reached the lowest level experienced in the period following the end of World War II. With the outbreak of hostilities in Korea, however, costs began to rise again. By the end of the year Bureau construction involving only labor and equipment rental reflected wage increases and higher equipment costs. Generally these increases were slight except in those instances where considerably lessened competition and uncertainty of labor supply in areas of intensive defense activity were contributing factors.

The cost of work embracing large amounts of construction materials and fabricated products became as high as or higher than at any time in the past. This is indicated in table 3, which lists cost indexes for construction work based on the combined costs of materials and labor furnished by contractors and material and labor furnished by the Government.

Bid prices for materials were widely varied and showed increases generally from 20 to 100 percent over June 1950. This was attributed primarily to shortages, real or anticipated, caused by stockpiling of materials expected to be in short supply or not available and by military purchases.

Table 3.—*Bureau of Reclamation Construction Cost Indexes—fiscal year 1951*

Cost indexes based on January 1940 costs=1.00	July 1950	January 1951	June 1951
Dams			
Earth	1.85	1.95	2.10
Concrete	1.95	2.15	2.25
Pumping plants:			
Building and equipment	2.00	2.15	2.30
Structures and improvements [1]	2.25	2.35	2.50
Equipment	1.70	2.00	2.10
Pumps and prime movers	1.70	1.95	2.20
Accessory electric and miscellaneous equipment	1.75	2.05	2.50
Discharge pipes	2.10	2.35	2.50
Canals and conduits:			
Canals	2.15	2.15	2.30
Conduits (tunnels, free flow, concrete lined)	2.20	2.30	2.35
Laterals and drains	2.35	2.45	2.50
Power plants, hydroelectric:			
Building and equipment	1.90	2.10	2.20
Structures and improvements [1]	2.20	2.35	2.45
Equipment	1.75	2.00	2.10
Turbines and generators	1.70	1.95	2.10
Accessory electrical equipment	1.75	2.10	2.10
Miscellaneous equipment	1.90	2.10	2.20
Penstocks	2.10	2.35	2.50
Transmission switchyards and substations	1.70	2.05	2.20
Transmission lines (wood pole)	1.80	1.90	2.20
Transmission lines (steel tower)	1.75	1.95	2.25
Permanent general property—buildings	2.15	2.50	2.60
Roads and bridges:			
Primary roads	1.95	2.05	2.25
Secondary roads, unsurfaced	1.80	1.90	2.10
Bridges	2.05	2.20	2.45
Composite index	2.00	2.15	2.25

[1] Indexes for structures and improvements on pumping plants and power plants are based on reinforced concrete structures.

Publications

Important advancements representing a cross section of engineering and scientific endeavors by the staff were recorded this year in Bureau technical publications.

Since publication of the Bureau's fifth edition of the Concrete Manual in 1949, its acceptance as an authoritative work on concrete control and concrete construction has been widespread and a reprint was required. Certain additions and corrections were incorporated in the reprint which is to be distributed early in the following year.

The Earth Construction Manual and Paint Manual will be made available for distribution early in fiscal year 1952. The first manual records engineering practices and procedures developed in earth materials testing and construction; the latter manual is an assemblage of procedures and techniques for control of paints and protective coatings.

Also published were three engineering monographs which discuss the design and construction of the Soap Lake Siphon, stress analysis of concrete pipe, and friction factors for large pipes.

Under preparation during the year were: a revised edition of Dams and Control Works; a revision of the Arc-Welding Manual under the title "Welding and Riveting Manual," which brings up to date and expands its present coverage to include other types of welding as well as riveting; a geology manual, presenting technical instructions relating to geological investigations; a hydraulic laboratory manual; a revision of the Manual for Measurement of Irrigation Water; a safety manual; a manual on bituminous construction; and additional engineering monographs.

The Advance Construction Bulletin and Advance Equipment Bulletin which report Bureau work proposed for the following 90 days were issued in increasingly greater numbers in response to requests from contractors and subcontractors. To promote increased competitive interest among wider numbers of prospective bidders, the bulletins were improved in format by inclusion of more details on work involved and on materials and equipment the construction contractor is to furnish and install.

Approximately 20 new maps were issued of Bureau projects or units of the Missouri River Basin plus a new edition of a wall-size map showing present and proposed Reclamation activities.

Table 4.—*Bureau of Reclamation dams*

State and project	Name of dam	River	Type	Capacity	Height	Length	Volume	Year
Arizona:								
Salt River	Bartlett	Verde	Concrete multiple-arch	[2] 179, 500	287	1, 063	182, 000	1939
	Cave Creek [1]	Cave Creek	do	11, 000	109	1, 648	18, 775	1923
	Horse Mesa	Salt	Concrete arch, power plant	[2] 245, 100	300	803	162, 000	1927
	Mormon Flat	do	do	[2] 57, 900	224	505	59, 900	1925
	Roosevelt	do	Masonry arch-gravity, power plant.	[2] 1, 398, 000	280	1, 125	355, 800	1911
	Stewart Mountain	do	Concrete arch, power plant	69, 800	207	1, 260	120, 500	1930
Arizona-California:								
Parker Dam Power	Parker [1]	Colorado	do	717, 000	320	856	380, 000	1938
Arizona-Nevada:								
Boulder Canyon	Hoover (Boulder)	do	Concrete arch-gravity, 2 power plants.	31, 142, 000	726	1, 244	4, 400, 000	1936
Davis Dam	Davis	do	Earth, power plant	1, 820, 000	200	1, 600	4, 357, 500	1950
California:								
Cachuma	Cachuma	Santa Ynez	Earth	312, 000	275	2, 975	6, 600, 000	(4)
Central Valley	Friant [1]	San Joaquin	Concrete gravity	521, 000	319	3, 488	2, 135, 000	1942
	Keswick [3]	Sacramento	do	23, 800	159	1, 046	197, 000	(4)
	Shasta	do	Concrete curved-gravity, embankment wing, power plant.	4, 493, 000	602	3, 460	6, 541, 000	1945
	Martinez	Offstream	Earth		38	1, 200	183, 450	1947
Orland	East Park	Little Stony Creek	Concrete arch-gravity	51, 000	139	226	15, 745	1910
	Stony Gorge	Stony Creek	Concrete slab-and-buttress	[2] 50, 200	139	868	43, 100	1928
Colorado:								
Colorado-Big Thompson	Carter Lake	Offstream	Earth (2 dikes)	117, 000	200	1, 235	2, 900, 000	(4)
	Dixon Canyon	do	Earth	(5)	240	1, 215	3, 004, 000	1949
	Granby	Colorado	do	546, 000	245	885	2, 901, 300	1950
	Green Mountain	Blue	Earth, power plant	154, 600	300	1, 150	4, 406, 000	1943
	Horsetooth	Offstream	Earth	147, 000	150	1, 610	1, 890, 000	1949
	Marys Lake [3]	do	Earth (2 dikes), power plant	700	40	1, 300	60, 500	(4)
	Olympus [1]	Big Thompson	Concrete gravity, embankment wing.	2, 850	60	1, 850	300, 000	1949
	Shadow Mountain	Colorado	Earth	15, 000	44	600	210, 000	1946
	Soldier Canyon	Offstream	do	(5)	220	1, 420	3, 288, 000	1949
	Spring Canyon	do	do	(5)	215	1, 115	2, 213, 000	1948
	Willow Creek	Willow Creek	do	11, 150	135	1, 075	330, 000	(4)
Fruit Growers	Fruit Growers	Alfalfa Run	do	4, 600	55	1, 520	135, 500	1938
Mancos	Jackson Gulch	Offstream	do	10, 000	181	1, 895	1, 988, 000	1948
Pine River	Vallecito	Pine	do	129, 700	162	4, 010	3, 738, 000	1941
Uncompahgre	Taylor Park	Taylor	do	[2] 106, 200	206	675	1, 115, 100	1937
San Luis Valley	Platoro	Conejos	do	67, 000	155	1, 525	940, 000	(4)

Idaho:								
Minidoka	American Falls	Snake	Concrete gravity, embankment wings.	² 1, 700, 000	94	5, 227	313, 600	1927
	Jackson Lake	do	do	² 847, 000	70	4, 920	491, 700	1911
	Minidoka [1]	do	Earth with concrete, power house section, power plant.	² 95, 200	86	4, 475	257, 300	1906
	Grassy Lake	Grassy Creek	Earth	15, 500	118	1, 170	541, 600	1939
	Island Park	Snake, Henry's Fork	do	127, 600	91	9, 448	464, 000	1938
Idaho-Oregon:								
Boise	Anderson Ranch	Boise, North Fork	Earth, power plant	498, 200	456	1, 350	9, 653, 300	1950
	Arrowrock	Boise	Concrete arch-gravity	² 286, 600	354	1, 150	636, 000	1915
	Cascade	Payette, North Fork	Earth	700, 000	107	785	395, 000	1948
	Deadwood	Deadwood	Concrete arch	164, 000	165	749	56, 400	1931
	Deer Flat, Upper	Offstream	Earth	190, 100	74	4, 000	1, 245, 000	1908
	Dear Flat, Lower	do	do		46	7, 200	1, 240, 000	1908
	Deer Flat, Middle	do	do		16	950	22, 500	1908
Kansas:								
Cedar Bluff (Missouri River Basin).	Cedar Bluff	Smoky Hill	do	368, 100	103	11, 000	8, 917, 000	(4)
Kansas-Colorado:								
St. Francis (Missouri River Basin.)	Bonny	South Fork, Republican	do	175, 000	160	9, 265	8, 530, 000	1951
Montana:								
Bitterroot	Como	Rock Creek	do	34, 800	65	2, 550	1, 106, 000	1910
Hungry Horse Dam	Hungry Horse	Flathead, South Fork	Concrete arch-gravity, power plant.	3, 500, 000	564	2, 115	2, 900, 000	(4)
Huntley	Anita	Offstream	Earth	² 400	42	1, 050	142, 800	1937
Milk River	Fresno	Milk	do	129, 100	111	2, 070	2, 105, 000	1939
	Nelson	Offstream	Earth (5 dikes)	85, 500	28	9, 900	232, 600	1915
	Sherburne Lakes	Swiftcurrent Creek	Earth	² 66, 100	96	1, 086	227, 600	1921
Sun River	Gibson	Sun, North Fork	Concrete arch	² 105, 000	196	960	167, 500	1929
	Pishkun	Offstream	Earth (8 dikes)	46, 400	50	9, 180	599, 300	1921
	Willow Creek	Willow Creek	Earth, semihydraulic fill	² 32, 400	93	650	254, 186	1911
Canyon Ferry (Missouri River Basin).	Canyon Ferry	Missouri River	Concrete gravity	2, 050, 000	220	1, 010	455, 600	(4)
Nebraska:								
Frenchman-Cambridge (Missouri River Basin).	Enders	Frenchman Creek	Earth	74, 000	134	2, 603	1, 951, 000	1950
Mirage Flats	Box Butte	Niobrara	do	31, 300	87	5, 508	1, 422, 000	1946
Frenchman-Cambridge (Missouri River Basin).	Medicine Creek	Medicine Creek	do	93, 000	180	5, 630	2, 883, 000	1950
	Trenton	Republican	do	172, 000	95	7, 800	(6)	(4)
Nebraska-Wyoming:								
North Platte	Guernsey	North Platte	Earth, power plant	48, 100	135	560	586, 200	1927
	Lake Alice, Upper	Offstream	Earth	11, 400	30	3, 100	240, 600	1913
	Lake Alice, Lower	do	do		23	2, 550	119, 000	1912
	Minatare	do	do	² 60, 800	63	3, 700	696, 100	1915
	Pathfinder	North Platte	Masonry arch-gravity	² 1, 070, 000	214	1, 070	65, 700	1909
	Pathfinder dike	do	Earth		38	1, 650	152, 200	1909
Nevada:								
Humboldt	Rye Patch	Humboldt	do	² 179, 000	80	914	356, 300	1936
Newlands	Lahontan	Garson	Earth, power plant	² 273, 600	162	5, 400	733, 100	1915
	Lake Tahoe [1]	Truckee	Concrete slab-and-buttress, lake outlet regulator.	² 732, 000	16	109	430	1913

See footnotes at end of table.

Table 4.—*Bureau of Reclamation dams*—Continued

State and project	Name of dam	River	Type	Capacity	Height	Length	Volume	Year
Nevada-California:								
Truckee River storage	Boca	Little Truckee	Earth	41, 200	116	1, 629	911, 900	1939
New Mexico:								
Carlsbad	Alamogordo	Pecos	Earth and rockfill	156, 800	148	3, 084	1, 914, 900	1937
	Avalon [1]	do	Earth	7, 000	58	1, 025	202, 300	1891
	McMillan	do	do	38, 700	57	2, 114	234, 000	1894
New Mexico-Texas:								
Rio Grande	Caballo [1]	Rio Grande	do	345, 900	112	4, 558	1, 244, 200	1938
	Elephant Butte	do	Concrete gravity, power plant (1940).	[2] 2, 219, 000	301	1, 674	629, 500	1916
North Dakota:								
Heart Butte (Missouri River Basin).	Heart Butte	Heart River	Earth	450, 000	174	1, 850	1, 222, 000	1949
Dickinson (Missouri River Basin).	Dickinson	do	do	16, 500	69	2, 225	326, 000	1950
Oklahoma:								
W. C. Austin	Altus [1]	Red, North Fork	Concrete gravity, masonry-faced.	[2] 151, 700	110	1, 112	70, 200	1945
Oregon:								
Baker	Thief Valley	Powder	Concrete slab-and-buttress	17, 400	70	390	6, 288	1932
Burnt River	Unity	Burnt	Earth, rock-faced	25, 800	83	675	253, 600	1938
Deschutes	Crane Prairie	Deschutes	Earth	55, 300	36	285	29, 700	1940
	Wickiup	do	do	180, 000	100	13, 860	1, 852, 000	1949
	Wickiup-East Dike	do	do		28	3, 420		1949
Umatilla	Cold Springs	Offstream	do	[2] 50, 000	117	3, 450	793, 400	1908
	McKay	McKay Creek	Earth, concrete-faced	[2] 73, 800	180	2, 700	2, 363, 800	1927
Vale	Agency Valley	Malheur, North Fork	Earth	59, 900	110	1, 850	645, 300	1935
	Warm Springs	Malheur, Middle Fork	Concrete arch	192, 400	106	469	19, 500	1919
Oregon-California:								
Klamath	Clear Lake	Lost	Earth	527, 000	39	840	63, 400	1910
	Gerber	Miller Creek	Concrete arch	[2] 94, 300	88	485	11, 900	1925
	Link River	Link	Concrete slab-and-buttress, lake outlet regulator.	[2] 873, 000	22	435	2, 200	1921
Oregon-Idaho:								
Owyhee	Owyhee [1]	Owyhee	Concrete arch-gravity	1, 120, 000	417	833	537, 500	1932
South Dakota:								
Angostura (Missouri River Basin).	Angostura	Cheyenne	Concrete gravity, embankment wing.	220, 000	187	1, 900	749, 600	1949
Belle Fourche	Belle Fourche	Owl Creek	Earth, concrete-faced	[2] 177, 500	122	6, 262	1, 783, 200	1911
Rapid Valley	Deerfield	Castle Creek	Earth	15. 700	133	825	607, 400	1947
Shadehill (Missouri River Basin).	Shadehill	Grand	do	467, 000	145	1, 900	3, 500, 000	1951
Texas:								
Colorado River	Marshall Ford	Colorado (Texas)	Concrete gravity, embankment wings, power plant.	1, 951, 300	278	5, 093	3, 579, 000	1942

Utah:								
Hyrum	Hyrum [1]	Little Bear	Earth	18, 800	116	540	435, 600	1935
Moon Lake	Midview	Offstream	do	5, 800	54	663	138, 900	1937
	Moon Lake	Lake Fork, West Fork	do	[2] 35, 800	110	1, 108	513, 100	1938
Newton	Newton	Clarkson Creek	do	5, 500	101	4, 781	410, 000	1946
Ogden River	Pine View	Ogden	do	43, 600	103	480	267, 700	1937
Provo River	Deer Creek	Provo	do	152, 600	235	1, 304	2, 827, 900	1941
Scofield Dam	Scofield	Price	do	73, 000	125	575	202, 700	1946
Strawberry Valley	Strawberry	Strawberry	do	283, 000	79	488	117, 900	1913
Weber River	Echo	Weber	do	73, 900	158	1, 887	1, 539, 800	1931
Washington:								
Columbia Basin	Grand Coulee	Columbia	Concrete gravity, 2 power plants and pumping plant.	9, 517, 000	550	4, 173	10, 585, 000	1942
	South Coulee	Offstream	Earth	1, 484, 000	94	9, 800	1, 605, 000	1949
	North Coulee	do	do		145	1, 400	1, 228, 000	1951
	Long Lake	do	do	62, 700	130	1, 900	1, 489, 000	1948
	O'Sullivan	Lower Crab Creek	do	606, 000	200	19, 000	9, 245, 000	1949
Okanogan	Conconully	Salmon Creek	Earth, hydraulic fill	[2] 13, 000	70	1, 000	359, 000	1910
	Salmon Lake	do	Earth	[2] 10, 500	42	1, 260	194, 900	1921
Yakima	Bumping Lake	Bumping	do	37, 300	45	3, 660	252, 600	1910
	Clear Creek	Tieton, North Fork	Concrete arch	5, 300	80	404	5, 800	1914
	Cle Elum	Cle Elum	Earth	529, 200	135	750	1, 411, 300	1933
	Kachess	Kachess	do	[2] 239, 000	114	1, 400	199, 600	1912
	Keechelus	Yakima	do	170, 500	103	6, 550	683, 500	1917
	Tieton	Tieton	Earth, semihydraulic fill	[2] 197, 000	235	920	2, 048, 600	1925
Wyoming:								
Boysen (Missouri River Basin)	Boysen	Big Horn	Earth, power plant	1, 493, 000	220	1, 000	1, 689, 000	([4])
Cheyenne (Missouri River Basin)	Keyhole	Belle Fourche	Earth	510, 000	165	3, 420	1, 300, 000	([4])
Eden	Big Sandy	Big Sandy Creek	do	65, 000	80	2, 300	840, 000	([4])
Kendrick	Alcova [1]	North Platte	do	190, 700	265	763	1, 635, 300	1938
	Seminoe	do	Concrete arch, power plant	[2] 1, 026, 000	295	530	210, 200	1939
Kortes Power (Missouri River Basin).	Kortes [3]	do	Concrete gravity, power plant	4, 800	240	440	147, 000	1951
Riverton	Bull Lake	Bull Lake Creek	Earth	[2] 152, 000	81	3, 456	819, 600	1938
	Pilot Butte	Offstream	Earth, semihydraulic fill	[2] 31, 600	51	1, 300	135, 300	1926
Wyoming-Montana:								
Shoshone	Deaver	do	Earth	680	14	1, 300	30, 300	1918
	Ralston	do	do	1, 500	35	2, 200	24, 700	1908
	Buffalo Bill	Shoshone	Concrete arch, power plant	[2] 456, 600	325	200	82, 900	1910

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[1] Storage and diversion—dam classified according to its principal feature.
[2] Live storage—dead storage not evaluated.
[3] Power dam—water supply for generation of power.
[4] Under construction.
[5] Horsetooth Reservoir formed by 4 dams.
[6] Not available.

NOTES

Capacity: Storage dams—acre-feet of reservoir storage provided by highest controlled water surface; diversion dams—second-feet of diversion provided by canal headworks at dam.

Height: Storage dams—feet between lowest point in foundation and normal crest of dam; diversion dams—feet between original streambed and highest controlled water surface.

Length: Feet of barrier in dam and integral features constructed between natural abutments.

Volume: Cubic yards of all material in dam and its appurtenent features.

Year: Date original construction was completed. (Tabular data include supplemental construction.)

FOREIGN ACTIVITIES

The degree of Bureau of Reclamation participation in the several authorized foreign technical assistance programs of the United States again showed an increase over previous years. Each year since the termination of World War II requests from abroad for the technical services of the Bureau have shown an increase in numbers and importance. To facilitate the administration of the Bureau's increased activities in the foreign field the Office of Foreign Activities has been established as an operating office under the Commissioner.

The most significant development in the program was the passage of the Act for International Development (Public Law 535, 81st Cong.) popularly known as the Point IV Act. Also of special note was the execution of a contract with ECA for rendering service to trainees, official observers, and accredited visitors that they refer to us. While this Government's Foreign Technical Assistance Programs are directed primarily at benefiting other countries the Bureau nevertheless profited greatly from the resulting mutual exchange of technical and general information regarding water-resources development the world over.

There were 22 missions overseas to 22 different countries involving 40 individuals in effect at one time or another during the last year—all as a result of specific requests from the countries concerned and with the approval of the Department of State, ECA, or other of the agencies administering a foreign program. Under the point 4 program missions were sent to Lebanon, Honduras, Costa Rica, Libya, Nicaragua, and Ecuador. Other Bureau personnel traveled to Australia, Afghanistan, Iran, Ceylon, Pakistan, and India to render technical assistance under the provisions of Public Law 402, Eightieth Congress. Our part in ECA's program included the loan to that agency of Bureau personnel for service in Italy, Greece, Turkey, Northern Rhodesia, Italian Somaliland, and Thailand. Other overseas missions included Guam, the Ryukyus, Saudi Arabia, and Puerto Rico at the request of the Navy, Army, the Food and Agriculture Organization of the United Nations, and the Puerto Rico Water Resources Authority, respectively.

Approximately 230 foreign officials and engineers from some 32 countries toured reclamation projects and visited Bureau Field Offices. Engineering trainees numbering 54, representing 12 foreign countries, studied Bureau engineering and administration practices in the Denver engineering offices and laboratories or at other Bureau offices.

During the last fiscal year Bureau employees were designated as official United States delegates or observers at the following international conferences: Large Electric High-Tension Systems, World Power Conference, Congress on Large Dams, Sectional Meeting of the World Power Conference, International Association of Hydraulic Research, UN Economic and Social Council Conference on Flood Control, International Commission on Irrigation and Canals, Fourth Inter-American Conference on Agriculture, and the UN International Institute for the Arid Zones. In addition to sending delegates to these conferences numerous papers were prepared by Bureau employees for presentation at the above meetings.

The Bureau also rendered testing, research, design review, and other similar services to foreign governments at their request and with the approval of the Department of State. Because of the Bureau's extensive and unique facilities for performing this type of work, the numbers of such requests continue to increase. Testing and design review in connection with the important Chao Phya Dam in Thailand is being carried out at that Government's request. In addition soils and material testing were performed for the Governments of Israel and Venezuela and for Bhakra Dam in India.

In addition to the above activities, hundreds of letters were received from foreign nationals requesting technical and general information, publications, reports, photographs, and similar material. Requested items and information were supplied insofar as facilities permitted. At the same time numerous exchange arrangements for technical information were established. Publication exchanges with foreign government agencies continued at an increased rate.

A further increase is anticipated in the scope and magnitude of the Bureau's part in this Government's foreign technical assistance programs during the coming fiscal year. Participation in worthwhile projects of this sort will continue insofar as the Bureau's domestic activities will permit and funds in connection therewith are made available.

OPERATION AND MAINTENANCE

Operation and Maintenance means providing irrigation water for 310,000 settlers on 100,000 farms which comprise almost 6 million acres of land, preparing land for settlement where ultimately many times the present number of settlers will become Reclamation farmers, and last, but not least, to see that thousands of miles of irrigation facilities throughout the 17 Western States are kept in good working order to conserve and use water to the greatest advantage, thus assuring service to the people of the area. These facilities include 107 storage and 68 diversion dams, more than 16,000 miles of canals and laterals, more than 3,500 miles of drains, 495 pumping plants and an estimated 6,000 miles of roads. In addition to the farm population, about 1,380,000 persons living in the nearby towns and villages are dependent upon the success of the Reclamation program.

Two new projects, the 3,500-acre Lewiston Orchards project in Idaho, and the 2,216-acre Savage Unit of the Yellowstone Division of the Missouri River Basin project in Montana, were added to the Reclamation family, making a total of 62 projects or divisions of projects now in operation. Six new agreements were made with State Agricultural Colleges and United States Department of Agriculture Agencies whereby information on the latest and most economical methods of irrigation farming will be obtained for Reclamation. This brings the total number of agreements in effect to 41.

The repayment program, another principal Operation and Maintenance activity, continued at top level during the year. Six amendatory contracts (revision of existing agreements between the Bureau and irrigation districts to adjust the charges paid by the farmers to the current economic situation) and 20 new water service and repayment contracts were executed during the period January 1, 1950, to June 30, 1951. The total value of all Bureau repayment contracts is $519,800,415 of which $88,739,714 has been repaid to date. Central Valley project districts signed 11 of these agreements indicating widespread support of the Bureau's program and policy, and making it possible for the Bureau to deliver Central Valley project water to the numerous valley customers.

Representatives of the Chief Engineer's Office conducted annual inspections of all major Bureau structures and facilities and the various project superintendents continued to conduct inspections of the minor structures and facilities to insure uninterrupted and equitable scheduled water deliveries. In addition to the inspection program, Bureau personnel are responsible for checking stream flow, conducting runoff forecasts, and measuring and delivering water.

Water users on the Grand Valley, Milk River, North Platte, Riverton, and Salt River projects executed contracts with the Bureau which paved the way for the Rehabilitation work on their respective projects.

Veteran settlement through public land homesteading and purchase of acquired lands continues to receive wide public attention throughout the Nation. Applications for farm units remain many times the number of units available.

Increased annual maintenance assumed by water users as part of the regular Operation and Maintenance work, and the Rehabilitation and Betterment program, which is handled in conjunction with the regular Operation and Maintenance program, resulted in the irrigation facilities being in more efficient operating condition than at any time during the past three decades.

During the year a reappraisal of the drainage program was made by all Regions to assure that it was meeting present needs. An active up-to-date drainage program is being formulated, and attention will be given to the need for day-to-day maintenance of facilities and preventive construction to keep additional lands from going out of production due to lack of proper drainage is being stressed.

The accelerated weed control program resulted in a tremendous saving in maintenance costs and cut water losses considerably. The development of aromatic solvents for controlling waterweeds was a high spot in the program and has resulted in saving thousands of dollars annually.

Extension of Irrigation Service

Facilities provided by the Bureau of Reclamation were expanded to extend full or supplemental service to a total of 6,025,000 irrigable acres in 1950. This represents an increase of 346,000 acres over the previous crop year. Of these irrigable acres, 5,077,000 were irrigated in 1950, which is an increase of 256,000 acres over 1949. The major increase in irrigation service occurred on the Central Valley project of California where supplemental water was provided for the first time this year to districts in which 172,000 acres were irrigated. Projects reporting the principal increases with the number of farms furnished a full or supplemental water supply for the first time during 1950 include the following:

Project or division of project	Irrigated	
	Number of farms	Acres
Boise project, Payette Division, second unit, Idaho	125	6, 093
Lewiston Orchards project, Idaho	1, 595	2, 750
Minidoka project, Idaho	344	2, 814
Deschutes project, north unit, Oreg	16	5, 922
Columbia Basin project, Wash	11	1, 734
Yakima project, Roza Division, Wash	300	12, 648
Central Valley project, Calif	2, 145	[1] 172, 205
Gila project, Yuma Mesa Division, Mesa unit, Ariz	0	759
All-American Canal system, Coachella Division, Calif	137	9, 622
Grand Valley project, Colo	[2] 100	200
Mancos project, Colo		555
Pine River project, Colo		264
Uncompahgre project, Colo		1, 502
Humboldt project, Nev		386
Newlands project, Nev		1, 660
Provo River project, Utah		3, 184
Tucumcari project, N. Mex	100	9, 053
Buffalo Rapids project, Mont	12	1, 528
Missouri River Basin project, Savage Unit, Yellowstone Division, Mont	28	2, 016
Riverton project, Wyo	55	6, 241
Shoshone project, Wyo	93	8, 787
Kendrick project, Wyo	9	[3] 1, 784
Total	5, 070	251, 707

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[1] Does not include 425 acres for rural homes receiving water in 1950.
[2] Estimates supplied.
[3] Includes acreage added to existing farms.

Table 5.—*Projects in operation—Irrigation and crop value data for the calendar year 1950*

State, project, and subdivision	Projects entirely constructed by the Bureau						
	Irrigable area [1]	Irrigated area	Land subject to construction charges			Temporarily suspended land [2]	
			Net area in cultivation	Crop values		Net area in cultivation	Total crop values
				Total	Per acre		
REGION 1							
IDAHO	*Acres*	*Acres*	*Acres*	*Dollars*	*Dollars*	*Acres*	*Dollars*
Lewiston Orchards [3]	3, 508	2, 750	2, 770	656, 950	237. 17		
Minidoka:							
American Falls Reservoir District No. 2	98, 976	86, 686	86, 945	4, 912, 983	56. 51		
Burley Irrigation District	47, 937	44, 335	44, 335	3, 398, 276	76. 65		
Minidoka Irrigation District	71, 882	62, 350	62, 350	4, 777, 577	76. 63		
Total—Minidoka project	218, 795	193, 371	193, 630	13, 088, 836	67. 60		
Rathdrum Prairie: Post Falls unit [3] [4]	3, 109	2, 108	2, 108	132, 371	62. 79		
IDAHO-OREGON							
Boise:							
Big Bend Irrigation District (Oregon)	1, 721	1, 398	1, 398	69, 017	49. 37		
Black Canyon Irrigation District (Notus)	6, 880	6, 573	6, 607	836, 281	126. 57		
Black Canyon Irrigation District (Payette)	51, 750	35, 481	36, 519	1, 869, 837	51. 20		
Boise-Kuna Irrigation District	48, 514	44, 927	45, 079	3, 127, 941	69. 39		
Nampa-Meridian Irrigation District	40, 262	34, 827	34, 828	2, 640, 932	75. 83		
New York Irrigation District	17, 826	14, 860	14, 893	660, 266	44. 33		
Settlers Irrigation District	518						
Wilder Irrigation District	56, 009	50, 382	50, 420	5, 505, 664	109. 20		
Total—Boise project	223, 480	188, 448	189, 744	14, 709, 938	77. 53		
MONTANA							
Bitter Root [3]	16, 665	16, 364	16, 492	548, 011	33. 23		
Frenchtown	4, 935	2, 833	3, 510	138, 750	39. 53		
OREGON							
Deschutes: North unit	50, 000	45, 889	46, 523	5, 224, 381	112. 30		

Umatilla:							
East Division	10, 911	6, 972	6, 972	281, 220	40. 34		
West Division	7, 620	4, 962	5, 094	177, 601	34. 86		
Total—Umatilla project	18, 531	11, 934	12, 066	458, 821	38. 03		
Vale	32, 000	31, 150	31, 150	1, 839, 715	59. 06		
OREGON-IDAHO							
Owyhee:							
Advancement Irrigation District	701	596	624	55, 337	88. 68	0	0
Bench Irrigation District	2, 319	2, 232	2, 251	379, 593	168. 63	0	0
Crystal Irrigation District	1, 263	1, 127	1, 127	156, 116	138. 52	0	0
Gem Irrigation District (Idaho)	33, 454	30, 855	30, 123	2, 927, 039	97. 17	863	41. 969
Ontario-Nyssa Irrigation District	5, 873	5, 621	5, 753	844, 245	146. 75	0	0
Owyhee Irrigation District	55, 742	51, 507	51, 672	4, 446, 600	86. 05	206	4, 152
Payette-Oregon Slope Irrigation District	4, 658	4, 153	4, 282	664, 997	155. 30	0	0
Slide Irrigation District	1, 144	1, 104	1, 104	123, 097	111. 50	0	0
Total—Owyhee project	105, 154	97, 195	96, 936	9, 597, 024	99. 00	1, 069	46, 121
WASHINGTON							
Columbia Basin:							
East Columbia Basin Irrigation District	80	77	77	12, 763	165. 75		
Quincy-Columbia Basin Irrigation District	211	174	174	11, 079	63. 67		
South Columbia Basin Irrigation District	6, 734	4, 102	4, 102	503, 486	122. 74		
Total—Columbia Basin project	7, 025	4, 353	4, 353	527, 328	121. 14		
Okanogan	5, 342	3, 955	3, 955	1, 171, 948	296. 32		
Yakima:							
Kittitas Division	59, 610	54, 216	54, 537	2, 924, 475	53. 62	0	0
Roza Division	71, 502	51, 291	51, 281	9, 337, 697	182. 09	5	177
Sunnyside Division	103, 579	80, 847	81, 294	12, 699, 888	156. 22	368	18, 498
Tieton Division	27, 271	24, 579	24, 660	13, 024, 333	528. 16	0	0
Total—Yakima project	261, 962	210, 933	211, 772	37, 986, 393	179. 37	373	18, 675
Total—Region 1	950, 506	811, 283	815, 009	86, 080, 466	105. 62	1, 442	64, 796
REGION 2							
CALIFORNIA							
Orland	19, 307	17, 075	17, 075	1, 792, 928	105. 00		
OREGON-CALIFORNIA							
Klamath:							
Main Division (Oregon)	41. 102	32, 396	32, 173	3, 182, 663	98. 92	579	21, 266
Tule Lake Division (California)	44, 327	42, 448	42, 481	5, 518, 025	129. 89	65	2, 611
Totals—Klamath project	85, 429	74, 844	74, 654	8, 700, 688	116. 55	644	23, 877
Totals—Region 2	104, 736	91, 919	91, 729	10, 493, 616	114. 40	644	23, 877

See footnote at end of table.

Table 5.—*Projects in operation—Irrigation and crop value data for the calendar year 1950*—Continued

State, project, and subdivision	Projects entirely constructed by the Bureau					Temporarily suspended land[2]	
	Irrigable area[1]	Irrigated area	Land subject to construction charges				
			Net area in cultivation	Crop values		Net area in cultivation	Total crop values
				Total	Per acre		
	Acres	*Acres*	*Acres*	*Dollars*	*Dollars*	*Acres*	*Dollars*
REGION 3							
ARIZONA							
Gila:							
Yuma Mesa Division:							
Yuma Mesa	20,251	7,067	7,067	729,270	103.19		
North Gila Valley	7,287	5,737	5,737	641,473	111.81		
Totals—Gila project	27,538	12,804	12,804	1,370,743	107.06		
Salt River	239,802	213,644	225,152	36,999,324	164.33		
ARIZONA-CALIFORNIA							
Yuma:							
Reservation Division:							
Indian Lands (California)	7,743	3,215	3,215	288,141	89.62		
Bard I. D. (California)	7,048	5,616	5,616	492,901	87.77		
Valley Division (Arizona)	52,991	47,367	47,048	9,800,331	208.30	400	0
Yuma Auxiliary (Unit B) (Arizona)	3,377	2,161	2,161	765,784	354.37	0	0
Totals—Yuma project	71,159	58,359	58,040	11,347,157	195.51	400	0
CALIFORNIA							
All-American Canal: Coachella Division[5]	48,000	31,600	31,000	[6] 13,437,977	433.48		
Totals—Region 3	386,499	316,407	326,996	63,155,201	193.14	400	0
REGION 4							
COLORADO							
Grand Valley:							
Gravity Division	30,444	20,692	21,527	1,514,606	70.36		
Orchard Mesa Irrigation District[3]	10,027	7,935	7,935	1,495,552	188.48		
Totals—Grand Valley project	40,471	28,627	29,462	3,010,158	102.17		
Uncompahgre	70,828	58,244	58,244	3,301,324	56.68		

NEVADA							
Newlands:							
North Carson Division	7, 973	3, 981	3, 901	177, 600	40. 83	80	1, 600
South Carson Division	54, 743	46, 543	43, 641	1, 671, 883	37. 89	3, 176	31, 760
Truckee Division	7, 065	4, 887	4, 834	203, 960	41. 78	53	1, 060
Totals—Newlands project	69, 781	55, 411	52, 376	2, 053, 443	39. 21	3, 309	34, 420
UTAH							
Strawberry Valley:							
High Line Division	18, 373	15, 696	16, 118	821, 851	50. 99		
Spanish Fork Division	13, 845	13, 362	13, 473	951, 572	70. 63		
Springville-Mapleton Division	9, 122	8, 509	8, 541	582, 821	68. 24		
Totals—Strawberry Valley project	41, 340	37, 567	38, 132	2, 356, 244	61. 79		
Totals—Region 4	222, 420	179, 849	178, 214	10, 721, 169	60. 16	3, 309	34, 420
REGION 5							
OKLAHOMA							
W. C. Austin	47, 810	45, 954	46, 856	3, 460, 601	73, 86		
NEW MEXICO							
Carlsbad	25, 055	19, 007	19, 007	3, 281, 474	172. 65		
Tucumcari	42, 321	31, 563	31, 563	1, 110, 368	35. 18		
NEW MEXICO-TEXAS							
Rio Grande:							
Elephant Butte Irrigation District (New Mexico)	88, 000	91, 521	85, 415	22, 700, 361	265. 77	6, 341	1, 068, 717
El Paso County Water Improvement District No. 1 (Texas)	67, 000	67, 183	63, 697	20, 104, 832	315. 63	3, 721	908, 366
Totals—Rio Grande project [7]	155, 000	158, 704	149, 112	42, 805, 193	287. 07	10, 062	1, 977, 083
Totals—Region 5	270, 186	255, 228	246, 538	50, 657, 636	205. 48	10, 062	1, 997, 083
REGION 6							
MONTANA							
Buffalo Rapids:							
First Division	15, 145	13, 724	13, 724	771, 256	56. 20		
Second Division	9, 475	6, 957	7, 621	297, 892	39. 09		
Totals—Buffalo Rapids project [4]	24, 620	20, 681	21, 345	1, 069, 148	50. 09		
Dodson Pumping Unit (Milk River) [4]	1, 173	1, 173	1, 173	63, 927	54. 50		
Huntley	32, 508	24, 812	16, 774	1, 136, 333	67. 74	8, 246	271, 679
Intake [4]	881	435	435	24, 258	55. 77		

See footnotes at end of table.

Table 5.—*Projects in operation—Irrigation and crop value data for the calendar year 1950*—Continued

State, project, and subdivision	Projects entirely constructed by the Bureau						
	Irrigable area [1]	Irrigated area	Land subject to construction charges			Temporarily suspended land [2]	
			Net area in cultivation	Crop values		Net area in cultivation	Total crop values
				Total	Per acre		
REGION 6—Continued							
MONTANA—continued							
Milk River:	*Acres*	*Acres*	*Acres*	*Dollars*	*Dollars*	*Acres*	*Dollars*
Chinook Division	43, 484	28, 549	28, 869	1, 760, 792	60. 99	0	0
Glasgow Division	19, 407	10, 130	10, 567	390, 071	36. 91	1, 635	36, 158
Malta Division	53, 733	25, 827	15, 780	684, 419	43. 37	10, 542	206, 619
Pump Lands	6, 755	6, 505	6, 755	436, 101	64. 56	0	0
Totals—Milk River project	123, 379	71, 011	61, 971	3, 271, 383	52. 79	12, 177	242, 777
Missouri River Basin project: Yellowstone Division, Savage Unit	2, 216	2, 016	2, 016	49, 417	24. 51		
Sun River:							
Fort Shaw Division	13, 902	6, 649	8, 352	198, 565	23. 77	94	1, 539
Greenfields Division	83, 346	61, 729	77, 601	1, 943, 896	25. 05	0	0
Totals—Sun River project	97, 248	68, 378	85, 953	2, 142, 461	24. 93	94	1, 539
MONTANA-NORTH DAKOTA							
Lower Yellowstone:							
District No. 1 (Montana)	37, 272	32, 865	32, 865	1, 812, 421	55. 15		
District No. 2 (North Dakota)	19, 928	16, 249	16, 249	963, 631	59. 30		
Totals—Lower Yellowstone project	57, 200	49, 114	49, 114	2, 776, 052	56. 52		
NORTH DAKOTA							
Buford-Trenton [4]	7, 915	7, 485	7, 625	373, 460	48. 98		
SOUTH DAKOTA							
Belle Fourche	59, 129	55, 472	54, 493	1, 981, 514	36. 36	979	21, 088

WYOMING							
Riverton:							
Midvale Irrigation District	48, 628	41, 517	42, 132	1, 933, 632	45. 89		
North Division	6, 236	4, 255	4, 933	81, 129	16. 45		
Totals—Riverton project	54, 864	45, 772	47, 065	2, 014, 761	42. 81		
WYOMING-MONTANA							
Shoshone:							
Frannie Division	20, 170	10, 921	10, 761	380, 541	35. 36	160	2, 722
Garland Division	41, 627	33, 923	33, 016	1, 649, 086	49. 95	907	17, 794
Heart Mountain Division	25, 182	17, 135	17, 135	727, 212	42. 44	0	0
Willwood Division	11, 426	10, 200	10, 525	526, 394	50. 01	0	0
Totals—Shoshone project	98, 405	72, 179	71, 437	3, 283, 233	45. 96	1, 067	20, 516
Totals—Region 6	559, 538	418, 528	419, 401	18, 185, 947	43. 36	22, 563	557, 599
REGION 7							
NEBRASKA							
Mirage Flats [4]	11. 598	11, 092	11, 092	676, 170	60. 96		
NEBRASKA-WYOMING							
North Platte:							
Gering-Fort Laramie Irrigation District	54, 846	52, 780	52, 780	3, 323, 189	62. 96	0	0
Goshen Irrigation District (Wyoming)	52, 487	43, 998	42, 495	2, 547, 393	59. 95	1, 503	26, 468
Northport Irrigation District	16, 170	12, 419	11, 484	415, 914	36. 22	935	3, 534
Pathfinder Irrigation District	112, 369	87, 581	74, 186	3, 897, 587	52. 54	13, 395	204, 715
Totals—North Platte project	235, 872	196, 778	180. 945	10, 184, 083	56. 28	15, 833	234, 717
WYOMING							
Kendrick	11, 933	6, 981	5, 772	135, 148	23. 41	1, 209	37, 474
Totals—Region 7	259, 403	214, 851	197, 809	10, 995, 401	55. 59	17, 042	272, 191
SUMMARY							
Region 1	950, 506	811, 283	815, 009	86, 080, 466	105. 62	1, 442	64, 796
Region 2	104, 736	91, 919	91, 729	10, 493, 616	114. 40	644	23, 877
Region 3	386, 499	316, 407	326, 996	63, 155, 201	193. 14	400	0
Region 4	222, 420	179, 849	178, 214	10, 721, 169	60. 16	3, 309	34, 420
Region 5	270, 186	255, 228	246, 538	50, 657, 636	205. 48	10, 062	1, 977, 083
Region 6	559, 538	418, 528	419, 401	18, 185, 947	43. 36	22, 563	557, 599
Region 7	259, 403	214, 851	197, 809	10, 995, 401	55. 59	17, 042	272, 191
Totals	2, 753, 288	2, 288, 065	2, 275, 696	250, 289, 436	109. 98	55, 462	2, 929, 966

See footnotes at end of table.

Table 5.—*Projects in operation—Irrigation and crop value data for the calendar year 1950*—Continued

State, project, and subdivision	Projects entirely constructed by the Bureau						
	Irrigable area [1]	Irrigated area	Land subject to construction charges			Temporarily suspended land [2]	
			Net area in cultivation	Crop values		Net area in cultivation	Total crop values
				Total	Per acre		
SUMMARY—continued	*Acres*	*Acres*	*Acres*	*Dollars*	*Dollars*	*Acres*	*Dollars*
Totals—Regular projects	2, 753, 288	2, 288, 065	2, 275, 696	250, 289, 436	109. 98		
Totals—Supplemental projects	603, 755	529, 410	536, 426	31, 648, 965	59. 00		
Totals—Special and Warren Act contractors	2, 626, 342	2, 219, 653	2, 271, 358	290, 554, 341	127. 92		
Additional areas reported:							
Temporarily suspended land			55, 462	2, 929, 966	52. 83		
Leased areas		40, 058	50, 521	2, 815, 001	55. 72		
Totals	5, 983, 385	5, 077, 186	5, 189, 463	578, 237, 709	111. 43		
Additional irrigable lands, no crop details reported [8]	41, 125						
Grand totals	6, 024, 510	5, 077, 186	5, 189, 463	578, 237, 709	111. 43		
Grand totals, 1949	5, 678, 512	4, 820, 589	4, 916, 234	516, 329, 008	105. 03		
Increase, 1949–50 totals	345, 998	256, 597	273, 229	61, 908, 701	6. 40		

State, project, and subdivision	Projects furnished supplemental storage water from works constructed by the Bureau					Special and Warren Act contractors receiving water from Bureau constructed works				
	Irrigable area [1]	Irrigated area	Net area in cultivation	Crop values		Irrigable area [1]	Irrigated area	Net area in cultivation	Crop values	
				Total	Per acre				Total	Per acre
REGION 1										
IDAHO										
	Acres	*Acres*	*Acres*	*Dollars*	*Dollars*	*Acres*	*Acres*	*Acres*	*Dollars*	*Dollars*
Minidoka: Fremont-Madison Irrigation District	112, 000	103, 458	107, 660	5, 851, 537	54. 35					
Total—Minidoka project	112, 000	103, 458	107, 660	5, 851, 537	54. 35	707, 870	685, 576	685, 576	44, 959, 800	65. 5
Rathdrum Prairie: Hayden Lake unit [3]	1, 087	514	514	31, 281	60. 86					

IDAHO-OREGON										
Boise: Total—Boise project						125, 303	116, 900	116, 900	11, 035, 000	94. 40
MONTANA										
Missoula Valley [4]	977	538	636	16, 869	26. 52					
OREGON										
Baker	7, 312	7, 255	7, 255	212, 080	29. 23					
Burnt River	15, 291	15, 260	15, 260	456, 960	29. 94					
Deschutes: Central Oregon Irrigation District	46, 713	42, 784	42, 784	3, 925, 398	91. 75					
Umatilla:										
West Division						1, 057	932	906	66, 004	72. 85
South Division:										
Stanfield Irrigation District	6, 000	5, 206	5, 259	411, 148	78. 18					
Westland Irrigation District	8, 030	4, 898	4, 920	257, 464	52. 33					
Total—Umatilla project	14, 030	10, 104	10, 179	668, 612	65. 69	1, 057	932	906	66, 004	72. 85
OREGON-IDAHO										
Owyhee: Total—Owyhee project						13, 800	13, 110	13, 110	1, 969, 194	150. 21
WASHINGTON										
Yakima: Total—Yakima project						191, 573	163, 223	163, 633	26, 936, 193	164. 61
Total—Region 1	197, 410	179, 913	184, 288	11, 162, 737	60. 57	1, 039, 603	979, 741	980, 125	84, 966, 191	86. 69
REGION 2										
CALIFORNIA										
Central Valley						697, 569	473, 662	504, 962	103, 013, 738	204. 00
OREGON-CALIFORNIA										
Klamath: Totals—Klamath project						86, 694	79, 974	79, 974	6, 081, 734	76. 05
Totals—Region 2						784, 263	553, 636	584, 936	109, 095, 472	186. 51
REGION 3										
ARIZONA										
Gila: Totals—Gila project						1, 056	1, 041	1, 041	126, 432	121. 45
Salt River						96, 651	84, 802	84, 802	23, 700, 788	279. 48
CALIFORNIA										
All-American Canal: Imperial Irrigation District						517, 000	420, 000	440, 000	56, 931, 231	129. 39
Totals—Region 3						614, 707	505, 843	525, 843	80, 758, 451	153. 58

See footnotes at end of table.

Table 5.—*Projects in operation—Irrigation and crop value data for the calendar year 1950*—Continued

State, project, and subdivision	Projects furnished supplemental storage water from works constructed by the Bureau					Special and Warren Act contractors receiving water from Bureau constructed works				
	Irrigable area [1]	Irrigated area	Net area in cultivation	Crop values		Irrigable area [1]	Irrigated area	Net area in cultivation	Crop values	
				Total	Per acre				Total	Per acre
REGION 4										
COLORADO	*Acres*	*Acres*	*Acres*	*Dollars*	*Dollars*	*Acres*	*Acres*	*Acres*	*Dollars*	*Dollars*
Fruitgrowers Dam	2,662	2,177	2,177	250,609	115.12					
Grand Valley: Totals—Grand Valley project						7,950	7,649	7,649	1,449,775	189.54
Mancos [4]	7,872	6,847	6,970	279,889	40.16					
Pine River	33,715	31,639	31,679	781,024	24.65	614	610	610	8,615	14.12
Uncompahgre						15,488	15,183	15,183	423,297	27.88
IDAHO										
Preston Bench [3]	4,324	4,150	4,150	303,197	73.06					
NEVADA										
Humboldt	40,012	25,414	25,414	1,574,894	61.97					
Truckee Storage	28,793	23,213	23,213	1,564,168	67.38					
UTAH										
Hyrum	6,460	5,682	5,760	340,674	59.14					
Moon Lake	72,608	59,894	60,044	1,298,362	21.62					
Newton [4]	2,225	1,872	1,884	124,922	66.31					
Ogden River	22,841	15,929	15,929	1,253,468	78.69					
Provo River: Deer Creek Division	46,609	40,890	42,158	2,895,291	68.68					
Sanpete:										
Ephraim Division	6,700	5,800	6,000	147,677	24.61					
Spring City Division	6,017	4,946	5,546	170,905	30.82					
Totals—Sanpete project	12,717	10,746	11,546	318,582	27.59					
Scofield [4]	15,609	14,909	15,009	817,776	54.49					
Strawberry Valley: Spanish Fork Division						3,837	3,711	3,732	236,433	63.35
Totals—Strawberry Valley project						3,837	3,711	3,732	236,433	63.35
Weber River (Salt Lake Basin)	90,791	90,791	90,861	7,390,754	81.34					
Totals—Region 4	387,238	334,153	336,794	19,193,610	56.99	27,889	27,153	27,174	2,118,120	77.95

REGION										
Rio Grande: Total—Rio Grande project [7]						17, 970	17, 382	17, 382	5, 081, 543	292. 35
TEXAS										
Balmorhea [4]	10, 191	6, 938	6, 938	1, 090, 452	157. 17					
Total—Region 5	10, 191	6, 938	6, 938	1, 090, 452	157. 17	17, 970	17, 382	17, 382	5, 081, 543	292. 35
REGION 6										
SOUTH DAKOTA										
Rapid Valley [4]	8, 916	8, 406	8, 406	202, 166	24. 05					
WYOMING										
Riverton: Total—Riverton project						2, 046	1, 994	1, 994	71, 788	36. 00
Total—Region 6	8, 916	8, 406	8, 406	202, 166	24. 05	2, 046	1, 994	1, 994	71. 788	36. 00
REGION 7										
NEBRASKA-WYOMING										
North Platte: Totals—North Platte project						139, 864	133, 904	133, 904	8, 462, 776	63. 20
Totals—Region 7						139, 864	133, 904	133, 904	8, 462, 776	63. 20
SUMMARY										
Region 1	197, 410	179, 913	184, 288	11, 162, 737	60. 57	1, 039, 603	979, 741	980, 125	84, 966, 191	86. 69
Region 2	0	0	0	0	0	784, 263	553, 636	584, 936	109, 095, 472	186. 51
Region 3	0	0	0	0	0	614, 707	505, 843	525, 843	80, 758, 451	153. 58
Region 4	387, 238	334, 153	336, 794	19, 193, 610	56. 99	27, 889	27, 153	27, 174	2, 118, 120	77. 95
Region 5	10, 191	6, 938	6, 938	1, 090, 452	157. 17	17, 970	17, 382	17, 382	5, 081, 543	292. 35
Region 6	8, 916	8, 406	8, 406	202, 166	24. 05	2, 046	1, 994	1, 994	71, 788	36. 00
Region 7	0	0	0	0	0	139, 864	133, 904	133, 904	8, 462, 776	63. 20
Totals	603, 755	529, 410	536, 426	31, 648, 965	59. 00	2, 626, 342	2, 219, 653	2, 271, 358	290, 554, 341	127. 92

Note.—Per acre value based on net area in cultivation.

[1] Area for which the Bureau is prepared to supply water.

[2] Generally part of irrigable area but not subject to construction charges until reclaimed.

[3] Private project reconstructed with Government funds.

[4] Water Conservation and Utilization project.

[5] Includes 16,306 acres irrigated from privately constructed facilities.

[6] Cost of grading, packing, storing, and containers excluded from values reported by Riverside County Agricultural Commissioner.

[7] Although there are 178,008 acres that can be irrigated within project limits, the area for which there is considered to be a safe and reliable water supply is 155,000 acres.

[8] Includes Arnold, Grants Pass, and Ochoco projects; Lone Pine Irrigation District, Deschutes project; and Indian Reservation Lands on Pine River project.

Crop Production

Crop production and irrigation service on Reclamation projects reached an all-time high in 1950. The volume of crops produced was over 16 million tons for the first time in Reclamation's history and the value of the crops was $578,238,000 which is an increase of $62,000,000 over 1949 and almost $23,000,000 over the 555 million dollar golden harvest of 1947, previous all-time high. This was the fifth successive year that the value of Reclamation crops topped the half-billion-dollar mark and for the same period the average per acre value of crops reached $111. The volume of vegetables, truck fruits and nuts, the "protective food," reached 5,613,000 tons or nearly 35 percent of the total crop.

The highest per acre crop value was found on the Coachella Division of the All-American Canal system where project water users received an average of $433 per acre for their crops. The high value received here is largely due to the large acreages of fruit and truck crop, mainly string beans and sweet corn and dates.

Including the crop returns for 1950, the cumulative value of crops grown in the 45 years since irrigation water was first supplied from Reclamation sources totals $7,161,808,000.

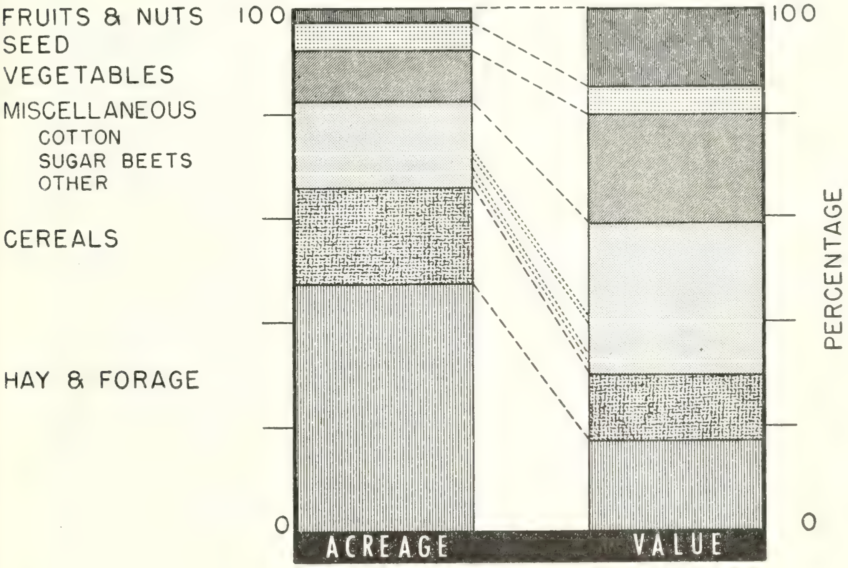
The types of crops raised on western irrigated lands include many products not available from other places in the United States. An outstanding record was achieved in 1950 in the production of cotton. Both medium and long staple cotton are produced. The value of the 454,000 bales of cotton lint and 184,000 tons of cottonseed grown by irrigation on Bureau projects was $111,531,168. Approximately 670,000 acres, or 13 percent of the entire irrigated area, was devoted to this valuable fiber crop.

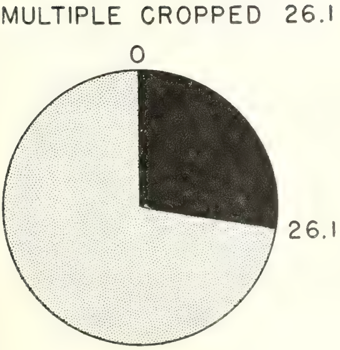
Yields of cotton, deciduous fruit, except in a few areas damaged by late spring frosts, and potatoes were excellent. Yields per acre of pears and peaches on regular projects in the Rocky Mountain States were especially hard hit by the bad weather. The production was almost a total loss in some instances. As a result of the small quantities of fruit produced, the price was higher than usual and some recovery was made in terms of total returns. The resulting total value of fruit on Reclamation projects substantially increased over 1949. Prices of grapes and cotton were good, with a resultant high gross value. The prices of potatoes generally, and of lettuce in the Southwest, were down from the previous year. Alfalfa and other hay was substantially the same as in the preceding year but the value of these commodities was relatively low when compared with other crops. Grains were about average on yield and price.

Water supplies were generally adequate, but shortages were apparent in the Salt River Valley of Arizona and on the Rio Grande project of New Mexico and Texas.

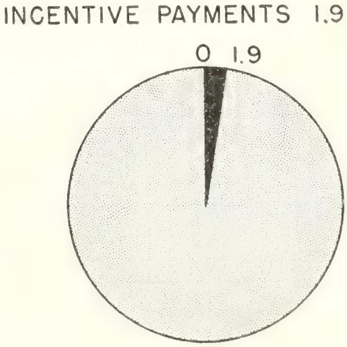
The cultivated area on which crop production is based amounted to 5,189,000 acres. This represents an increase of 273,000 acres from the previous crop year. Shifts in the cropping pattern on this irrigated acreage included generally a reduction in the amount of cereal grains, principally wheat, general increases in the acreage devoted to seed crop production, and substantial acreages devoted to cotton.

ACREAGE AND VALUE COMPARISONS





CROP USE



RECEIPTS

Table 6.—*Cumulative crop values—1906–50**

Year	Federal irrigation projects [1]					Warren Act lands and special contractors					Entire area				
	Irrigable acreage	Irrigated acreage	Net area in cultivation	Total crop value		Irrigable acreage	Irrigated acreage	Net area in cultivation	Total crop value		Irrigable acreage	Irrigated acreage	Net area in cultivation	Total crop value	
				For year	Cumulative total				For year	Cumulative total				For year	Cumulative total
1906	39,300	[2] 22,300	[2] 20,100	[2] $244,900	------	------	------	------	------	------	39,300	[2] 22,300	[2] 20,100	[2] $244,900	------
1907	266,300	[2] 187,628	[2] 169,000	[2] 4,760,460	$5,005,360	------	------	------	------	------	266,300	[2] 187,628	[2] 169,000	[2] 4,760,460	$5,005,360
1908	488,942	[2] 289,549	[2] 260,500	[2] 7,635,888	12,641,248	------	------	------	------	------	488,942	[2] 289,549	[2] 260,500	[2] 7,635,888	12,641,248
1909	730,601	410,628	410,628	11,920,663	24,561,911	------	------	------	------	------	730,601	410,628	369,500	11,920,663	24,561,911
1910	917,751	473,423	473,423	12,974,639	37,536,550	------	------	------	------	------	917,751	473,423	413,000	12,974,639	37,536,550
1911	1,042,609	564,681	564,681	13,121,224	50,657,774	------	------	------	------	------	1,042,609	564,681	470,100	13,121,224	50,657,774
1912	1,205,236	618,680	641,397	14,479,368	65,137,142	------	------	------	------	------	1,205,236	618,680	540,000	14,479,368	65,137,142
1913	1,255,381	699,183	642,216	15,732,215	80,869,357	------	------	------	------	------	1,255,381	699,183	637,227	15,732,215	80,869,357
1914	1,240,875	761,271	703,424	16,475,517	97,344,874	------	------	------	------	------	1,240,875	761,271	703,424	16,475,517	97,344,874
1915	1,472,772	856,778	757,613	18,164,452	115,509,326	------	------	------	------	------	1,472,772	856,778	760,035	18,164,452	115,509,326
1916	1,405,452	922,821	858,291	32,815,972	148,325,298	------	------	------	------	------	1,405,452	922,821	858,291	32,815,972	148,325,298
1917	1,599,525	1,057,513	966,784	56,462,313	204,787,611	------	------	------	------	------	1,599,525	1,057,513	966,784	56,462,313	204,787,611
1918	1,732,374	1,141,516	1,051,193	66,821,396	271,609,007	951,987	[2] 501,100	[2] 481,600	[2] $35,000,000	------	2,684,361	[2] 1,642,616	[2] 1,532,793	[2] 101,821,396	306,609,007
1919	1,636,159	1,187,255	1,113,469	88,974,137	360,583,144	1,011,815	916,313	880,613	54,004,750	$99,004,750	2,647,974	2,103,568	1,994,082	152,978,887	459,587,894
1920	1,661,960	1,223,480	1,153,820	66,171,650	426,754,794	1,183,292	981,940	950,890	47,505,770	146,510,520	2,845,252	2,205,420	2,104,710	113,677,420	573,265,314
1921	1,674,100	1,227,500	1,157,900	49,620,300	476,375,094	1,146,810	1,001,250	969,550	44,906,130	191,416,650	2,820,910	2,228,750	2,127,450	94,526,430	667,791,744
1922	1,692,700	1,202,130	1,169,100	50,360,850	526,735,944	1,101,700	983,290	951,270	33,240,840	224,657,490	2,794,400	2,185,420	2,120,370	83,601,690	751,393,434
1923	1,718,400	1,213,700	1,179,870	65,046,300	591,782,244	1,231,400	1,051,380	993,040	37,557,860	262,215,350	2,949,800	2,265,080	2,172,910	102,604,160	853,997,594
1924	1,805,730	1,290,890	1,216,610	66,488,560	658,270,804	1,237,885	930,670	889,460	43,237,470	305,452,820	3,043,615	2,221,560	2,106,070	109,726,030	963,723,624
1925	1,802,970	1,320,300	1,242,750	77,608,880	735,879,684	1,340,000	1,019,170	951,250	53,655,850	359,108,670	3,142,970	2,339,470	2,194,000	131,264,730	1,094,988,354
1926	1,844,550	1,411,020	1,361,470	60,664,900	796,544,584	1,329,020	1,097,190	949,590	49,750,040	408,858,710	3,173,570	2,508,210	2,278,400	110,414,940	1,205,403,294
1927	1,956,910	1,378,990	1,431,560	72,047,200	868,591,784	1,482,950	1,148,115	1,072,486	61,160,010	470,018,720	3,439,860	2,527,105	2,399,296	133,207,210	1,338,610,504
1928	1,882,930	1,442,080	1,489,240	81,077,750	949,669,534	1,490,735	1,235,020	1,192,030	62,495,320	532,514,040	3,373,665	2,677,100	2,577,590	143,573,070	1,482,183,574
1929	1,922,330	1,483,900	1,512,250	88,459,390	1,038,128,924	1,480,040	1,234,230	1,192,990	72,720,490	605,234,530	3,402,370	2,718,130	2,613,060	161,179,880	1,643,363,454
1930	1,993,390	1,504,810	1,550,967	65,007,270	1,103,136,194	1,640,722	1,286,046	1,254,493	54,654,550	659,889,080	3,634,112	2,790,856	2,721,590	119,661,820	1,763,025,274
1931	2,027,264	1,552,718	1,520,354	40,554,037	1,143,690,231	1,588,972	1,293,889	1,251,830	33,406,340	693,295,420	3,616,236	2,846,607	2,714,395	73,960,377	1,836,985,651
1932	2,039,074	1,555,144	1,578,880	31,531,162	1,175,221,393	1,512,405	1,214,461	1,196,400	18,627,219	711,922,639	3,551,479	2,769,605	2,702,720	50,158,381	1,887,144,032
1933	2,025,508	1,589,770	1,598,702	48,765,863	1,223,987,256	1,514,201	1,239,017	1,199,113	35,425,870	747,348,509	3,539,709	2,828,787	2,797,815	84,191,733	1,971,335,765
1934	1,986,268	1,552,124	1,527,104	60,928,969	1,284,916,225	1,508,377	1,285,081	1,229,594	40,014,745	787,363,254	3,494,645	2,837,205	2,693,999	100,943,714	2,072,279,479
1935	2,113,506	1,640,936	1,604,166	63,601,663	1,348,517,888	1,500,589	1,294,680	1,256,970	43,179,631	830,542,885	3,614,095	2,935,616	2,861,136	106,781,294	2,179,060,773
1936	2,166,409	1,702,192	1,629,174	78,902,818	1,427,420,706	1,527,008	1,335,995	1,272,745	57,599,662	888,142,547	3,693,417	3,038,187	2,901,919	136,502,480	2,315,563,253
1937	2,194,830	1,725,463	1,700,969	72,893,649	1,500,314,355	1,571,382	1,389,338	1,333,800	45,764,623	933,907,170	3,766,212	3,114,801	3,034,769	118,658,272	2,434,221,525
1938	2,275,882	1,777,584	1,764,363	67,859.804	1,568,174,159	1,507,051	1,329,115	1,276,332	45,603,656	979,510,826	3,782,933	3,106,699	3,040,695	113,463,460	2,547,684,985
1939	2,492,740	1,922,868	1,903,269	73,769,654	1,641,943,813	1,396,800	1,218,108	1,174,803	40,313,140	1,019,823,966	3,889,540	3,140,976	3,078,072	114,082,794	2,661,767,779
1940	2,780,811	2,152,808	2,138,927	80,098,196	1,722,042,009	1,399,057	1,238,262	1,177,103	37,690,481	1,057,514,447	4,179,868	3,391,070	3,316,030	117,788,677	2,779,556,456

1941	3, 547, 816	2, 199, 179	2, 178, 288	110, 399, 807	1, 832, 441, 816	1, 398, 338	1, 249, 204	1, 202, 172	49, 486, 191	1, 107, 000, 638	4, 946, 154	3, 448, 383	3, 380, 460	159, 885, 998	2, 939, 442, 454
1942	3, 487, 944	2, 688, 723	2, 615, 048	193, 783, 707	2, 026, 225, 523	1, 360, 757	1, 247, 512	1, 206, 651	78, 264, 809	1, 185, 265, 447	4, 484, 701	3, 936, 235	3, 821, 699	272, 048, 516	3, 211, 490, 970
1943	2, 957, 806	2, 422, 288	2, 398, 922	218, 064, 208	2, 244, 289, 731	1, 896, 026	1, 633, 041	1, 615, 424	170, 606, 761	1, 355, 872, 208	4, 853, 832	4, 055, 329	4, 014. 346	388, 670, 969	3, 600, 161, 939
1944	2, 970, 714	2, 468, 842	2, 475, 280	224, 683, 280	2, 468, 973, 011	1, 969, 281	1, 694, 861	1, 664, 069	186, 543, 084	1, 542, 415, 292	4, 939, 995	4, 163, 703	4, 139, 349	411, 226, 364	4, 011, 388, 303
1945	2, 975, 590	2, 416, 961	2, 464, 672	232, 545, 321	2, 701, 518, 332	2, 054, 746	1, 745, 627	1, 731, 060	202, 639, 074	1, 745, 054, 366	5, 030, 336	4, 162, 588	4, 195, 732	435, 184, 395	4, 446, 572, 698
1946	3, 079, 761	2, 513, 687	2, 567, 050	279, 711, 300	2, 981, 229, 632	2, 071, 070	1, 808, 282	1, 829, 531	250, 912, 645	1, 995, 967, 011	5, 150, 831	4, 321, 969	4, 396, 581	530, 623, 945	4, 977, 196, 643
1947	3, 091, 977	2, 629, 727	2, 683, 253	300, 474, 560	3, 281, 704, 192	2, 074, 806	1, 831, 975	1, 871, 099	254, 946, 244	2, 250, 913, 255	5, 166, 783	4, 461, 702	4, 554, 352	555, 420, 804	5, 532, 617, 447
1948	3, 221, 464	2, 664, 619	2, 760, 493	277, 160, 874	3, 558, 865, 066	2, 158, 551	1, 894, 136	1, 939, 241	257, 462, 667	2, 508, 375, 922	5, 380, 015	4, 558, 755	4, 699, 734	534, 623, 541	6, 067, 240, 988
1949	3, 296, 297	2, 792, 108	2, 848, 896	277, 347, 763	3, 836, 212, 829	2, 382, 215	2, 028, 481	2, 067, 338	238, 981, 245	2, 747, 357, 167	5, 678, 512	4, 820, 589	4, 916, 234	516, 329, 008	6, 583, 569, 996
1950	3, 398, 168	2, 857, 533	2, 918, 105	287, 683, 368	4, 123, 896, 197	2, 626, 342	2, 219, 653	2, 271, 358	290, 554, 341	3, 037, 911, 508	6, 024, 510	5, 077, 186	5, 189, 463	578, 237, 709	7, 161, 807, 705

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* Revised.

[1] Includes projects constructed by the United States and those for which supplemental water is furnished from storage works built by the United States.

[2] Estimated.

Livestock and equipment inventory of project farmers on November 1, 1950, showed an increase in value to 271 million dollars or an increment of 51 million dollars over the previous year. Of this total, the value of livestock amounted to 118 million dollars, while equipment constituted 153 million dollars, or 56 percent of the total inventory value. A portion of the increase in value was due to advances of prices by the latter part of the year, but the stimulation of the Korean War caused extensive purchasing of equipment, in anticipation of difficulties of procuring machinery in the event of a protracted struggle. This stockpiling is in direct contrast to the situation when the inventory increase probably was not much more than sufficient to replace worn-out equipment. Thus in 1950 the inventory increase of farm equipment amounted to 17 percent more than the preceding year which had increased 7 percent over 1948.

The livestock were accounted for by a preponderance of cattle, representing 78 percent of the total inventory. Of this percentage, 48 percent were mainly beef or unsegregated cattle while 29 percent were dairy stock. Of the remaining livestock, sheep represented 13 percent, poultry 4 percent, hogs 3 percent, horses and mules 2 percent, and miscellaneous livestock 1 percent, respectively, of the total livestock inventory.

Protective Foods

Crops that make up the impressive total tonnage include feed and forage essential in attaining balanced land use of the western range—important in livestock production. Cotton, sugar beets, and choice cereals were also included in the Reclamation farmers crop rotation. Most important, however, was the tremendous variety of fruits, nuts, vegetables, and truck crops which now make up such an important portion of the American diet.

Of the 16 million tons of strategic food and fiber produced on Reclamation lands over 5.6 million tons were fruits, nuts, vegetables, and truck crops. Thus nearly one-third of the 1950 harvest was in those highly prized crops which are classed as "protective foods" by our dieticians. Many of these crops are grown exclusively under irrigation. In fact, a very large portion of the Nation's highly prized fruits, nuts, and vegetables comes from irrigated land in the western United States. In 1948, the 11 Western States produced virtually all of our apricots, almonds, dates, lemons, figs, prunes, and olives, 95 percent of the grapes, over 90 percent of the lettuce, 85 percent of the sweet cherries, 75 percent of the avocados, pears, and cantaloupes, 65 percent of the asparagus, 50 percent of the peaches, and over 50 percent of all truck crops.

Operation and Maintenance of Irrigation Systems

As a result of the detailed attention paid to problems associated with the storage, regulation, and distribution of irrigation water supplies, and the maintenance of structures and distribution systems, crops were matured profitably on all operating projects during the calendar year 1950 despite water shortages resulting from the long-continued drouth in the Southwest. On some projects where surface water was not adequate, ground water was pumped to supplement supplies.

Irrigation water was delivered to the water users during fiscal year 1951 without a major break in the distribution system of any Bureau-operated project. Better results in operation of some of the older projects are showing up as a result of completion of all or of the first stages of the rehabilitation and betterment programs on those projects.

Progress was continued on investigations of and improvements in drainage conditions, and on water-conservation programs, including reductions in distribution-system losses, sprinkler-irrigation investigations, education for better farm-irrigation practices, weed control, and reuse of return flows, all aimed at fuller utilization of existing water resources.

In accordance with established Congressional and Departmental policy, responsibilities for the operation and maintenance of three projects or units thereof were transferred to the water users during the fiscal year. These were the Midvale Irrigation District of the Riverton project in Wyoming, the Mirage Flats project in Nebraska, and the Balmorhea project in Texas. Completed portions of the Salt Lake Aqueduct, Utah, and of the Coachella distribution systems, California, likewise were transferred for operation and maintenance by the water users organizations. Negotiations were completed during the year for effecting the transfer of the Valley Division of the Yuma, Ariz., project to the water users on July 1, 1951, at the start of fiscal year 1952.

Rehabilitation and Betterment

The Rehabilitation and Betterment Program of the Bureau of Reclamation, based on Public Law 335 of the Eighty-first Congress, First Session, as amended, continued to move forward in many areas. This program requires full reimbursement by the water users of all funds expended. In most cases, the Rehabilitation and Betterment Program has required the negotiation and execution of supplemental repayment contracts. All of these contracts require approval of repayment rates and schedules by the Senate and House Committees on

Interior and Insular Affairs before expenditures can be made on rehabilitation and betterment work. Contracts for the repayment of rehabilitation and betterment work were executed on the following projects:

Arizona: Salt River project.
Colorado: Grand Valley project.
Montana: Milk River project.
Nebraska–Wyoming: North Platte project.
Wyoming: Riverton project.

Arrangements for repayment of rehabilitation work on the Belle Fourche project, South Dakota; Orland project, California; Bitter Root project, Montana; Vale project, Oregon; Shoshone project, Wyoming; and the Storage Division of the Yakima project in Washington are provided for by existing contracts with irrigation districts and water user associations.

In addition, contracts for repayment of rehabilitation and betterment work on the Okanogan project, Washington, and the Sun River project, Montana, have been approved by the appropriate Congressional Committee and are now awaiting execution by the water users.

A total of $3,000,000 appropriated by the Congress for this item was allotted as follows:

Project:	*Allotment*
Salt River, Ariz	$1,200,000
Orland, Calif	4,000
Grand Valley, Colo	810,000
Milk River, Mont	153,000
North Platte, Wyo.-Nebr	426,000
Belle Fourche, S. Dak	100,000
Yakima, Wash	48,674
Riverton, Wyo	226,320
Shoshone, Wyo	32,000
Total	3,000,000

All work contemplated under the rehabilitation and betterment program for accomplishment on the Orland (Calif.), Vale (Oreg.), and Bitter Root (Mont.) projects was completed during the year, the latter two entirely with funds carried over from fiscal year 1950 allotments.

The work on the various projects included replacement of old wood structures; repair or replacement of old concrete and steel structures; cleaning and repair of canals, laterals, wasteways, and drains; installation of canal lining to prevent excessive water losses; construction of drains; construction and repair of roads, cattle guards, fences, and many other items as required to place the projects in first-class operating condition.

Cooperation With Design and Construction

Cooperation between the Branches of Design and Construction and Operation and Maintenance continued to improve during the past year. The appointment of a special liaison officer during the previous year for the purpose of inspecting, compiling, and interpreting operating results on all existing projects for the benefit of design personnel engaged on the preparation of designs and specifications for new projects has been particularly effective. In his efforts, the liaison officer has received guidance and full support from both the Chief Engineer and the Director of the Branch of Operation and Maintenance.

Amendatory and New Repayment and Water Service Contracts

The progress made in the past few years in executing new and amendatory repayment contracts with water users' organizations continued with good results during the period January 1, 1950, to June 30, 1951. Negotiations of basic amendatory repayment contracts for the Hyrum and Ogden River projects, Utah, were completed under section 7 of the Reclamation Project Act of 1939. These contracts accomplished needed financial adjustments for the South Cache Water Users' Association and the Ogden River Water Users' Association, and were approved by the Congress by the enactment of Public Laws 666 and 667, Eighty-first Congress, Second Session.

Negotiations of basic amendatory repayment contracts involving financial adjustments for the nine irrigation districts, Advancement, Bench, Crystal, Gem, Ontario-Nyssa, Owyhee, Payette-Oregon Slope, Slide, and Ridgeview, which comprise the Owyhee project, Oregon-Idaho, and for the Malta and Glasgow Irrigation Districts of the Milk River project, Mont., are virtually complete and Secretarial reports thereon are being readied for submittal to the Congress pursuant to section 7 of the Reclamation Project Act of 1939.

Other amendatory repayment contracts executed during this period, but not requiring action by the Congress, included contracts with the following water users' organizations:

Colorado: Colorado-Big Thompson project, Northern Colorado Water Conservancy District.

Idaho: Boise project, Wilder Irrigation District.

New Mexico: Rio Grande project, Hudspeth County Conservation and Reclamation District No. 1.

Oregon-California: Klamath project, Klamath Irrigation District.

At the close of FY 1951, substantial progress had been made in financial adjustment investigations designed to provide a sound basis for negotiating amendatory repayment contracts on the following projects:

Idaho: Boise project, Black Canyon Irrigation District, Nampa and Meridian Irrigation District.

Montana: Frenchtown project, Frenchtown Irrigation District.

Oregon: Deschutes project, North Unit Irrigation District; Umatilla project, Hermiston Irrigation District, West Extension Irrigation District.

Washington: Yakima project, Roza Irrigation District.

Wyoming: Kendrick project, Casper-Alcova Irrigation District.

Financial adjustment investigations were commenced during FY 1951 on a number of additional projects. At the close of FY 1951, substantial progress had been made also in connection with acquisition of the power system and negotiation of amendatory contracts with the districts in the North Platte project in Nebraska and Wyoming.

New water service and repayment contracts were executed in calendar year 1950 and until June 30, 1951, with the following water users' organizations:

Arizona-California: Yuma project, sale of waste water to Mexican interests, Yuma County Water Users' Association (Operation and Maintenance Transfer contract).

California: Central Valley project, Chowchilla Water District, Contra Costa County Water District (interim), Exeter Irrigation District, Lindsay-Strathmore Irrigation District, Lower Tule River Irrigation District, Madera Irrigation District, Saucelito Irrigation District, Stone Corral Irrigation District, Terra Bella Irrigation District, Tulare Irrigation District, temporary 1950 and 1951 water service contracts (numerous districts in San Joaquin Valley).

Kansas: Missouri River Basin project, Kansas Bostwick Irrigation District No. 2.

Montana: Milk River project, city of Havre (Municipal Water).

Nebraska: Mirage Flats project, Mirage Flats Irrigation District.

New Mexico: Tucumcari project, city of Tucumcari (Municipal Water).

Oregon: Ochoco project, Ochoco Irrigation District.

South Dakota: Missouri River Basin project, Angostura Irrigation District.

Wyoming: Eden project, Eden Valley Irrigation and Drainage District; North Platte project, city of Casper (Municipal Water).

At the close of the fiscal year, negotiations had been completed on a number of additional contracts which were pending formal execution by either the water users' organizations or the United States. These involved contracts with the following water users' organizations:

Arizona: Gila project, North Gila Valley Irrigation District; Yuma Auxiliary project, Unit B Irrigation and Drainage District.

California: Central Valley project, Buckeye Water District, Contra Costa County Water District, Delano-Earlimart Irrigation District, Porterville Irrigation District; Cachuma project, temporary water service contracts (contemplated with several districts).

Montana: Buffalo Rapids project, Buffalo Rapids Irrigation District No. 1.

Nebraska: Missouri River Basin project, Frenchman-Cambridge Irrigation District.

North Dakota: Missouri River Basin project, Fort Clark Irrigation District, Heart River Irrigation District.

Oregon-California: Klamath project, Langell Valley Irrigation District.

South Dakota: Missouri River Basin project, Belle Fourche Irrigation District (Keyhole unit).

Wyoming: Missouri River Basin project, Owl Creek Irrigation District.

In addition, detailed physical and economic investigations were completed and negotiations were well advanced on more than a score of contracts involving other new projects or new units of projects.

Items in the new contract program of particular note during the past year included court confirmation of a revised water service and repayment contract with the Frenchman-Cambridge Irrigation District, Nebraska, Missouri River Basin project. On the last day of the fiscal year, the judge of the superior court of Red Willow County, Nebr., indicated that he would enter an order confirming the proposed contract as revised following court disapproval of the preceding contract executed in 1947.

The first water service and repayment contract for the Missouri River Basin project in South Dakota was executed on May 29, 1951, with the Angostura Irrigation District. The first Missouri River Basin contract in Kansas was also executed—with the Kansas Bostwick Irrigation District No. 2.

The Supreme Court of North Dakota in actions involving the Fort Clark Irrigation District cleared the way for early execution of the first irrigation water service and repayment contract for the Missouri River Basin project in North Dakota.

The changing construction-cost picture arising in connection with the Defense Program and the Korean situation may result in the need for additional repayment contract coverage for some of the projects now under construction. Building as the Bureau does on a strictly cost basis, when significant changes in costs occur, it is the policy of the Bureau of Reclamation to advise the water users' organizations of these increases in costs as soon as possible and where necessary to negotiate supplemental repayment contracts to cover the added costs. The Bureau of Reclamation, since it operates on a cost basis, does not have the opportunity that private contractors have of making up losses on one contract by profits on another.

Expansion of the urban population in the West, and the growing water requirements of the National Defense Program in Western States, have called for additional contract activities related to the furnishing of municipal and industrial water from Reclamation projects. These contract activities have included not only the negotiations with municipal water users seeking new and supplemental water supplies for municipal and industrial purposes, but also in connection with furnishing additional supplies to military installations and certain defense industries closely related to the National Defense Program. In accordance with the policy of the Secretary of the Interior water charges for municipal and industrial purposes have included payment of interest on the construction cost at 2 percent.

Federal Income Taxes From Reclamation Areas

Federal income, corporation, excise, and other tax payments received directly or indirectly from Reclamation project areas are estimated to aggregate about 2.3 billion dollars. This is based on a sample analysis of 15 Federal Reclamation projects which are estimated to have produced over 68 million dollars in individual income taxes alone during 1950 with the total of these payments since the building of these projects amounting to over one-half billion dollars. Other Federal tax payments in these areas are estimated at approximately a quarter of a billion dollars. Thus total Federal revenues in 15 project areas are estimated in excess of three-quarter billion dollars. These revenues constitute a partial measure of the extent to which Reclamation projects contribute to the stability, productive capacity, and defense of the Nation.

Rough estimates have been made of the Federal individual income taxes paid directly and indirectly from 15 Federal Reclamation project areas. These estimates include taxes paid by irrigation farmers, townspeople, and business in the general project area. For these 15 elected areas, it is estimated that approximately $68,000,000 of Federal individual income taxes were paid in 1950 and about $525,000,000 ince development of the areas.

Estimated individual income taxes

Project	1950	Total
elle Fourche	$260,000	$2,532,000
itter Root	224,000	2,060,000
oise	10,082,000	66,405,000
arlsbad	836,000	4,744,000
untley	217,000	1,881,000
ower Yellowstone	441,000	4,343,000
ilk River	558,000	4,276,000
io Grande	8,468,000	51,215,000
iverton	179,000	1,750,000
alt River	23,495,000	187,675,000
hoshone	245,000	2,870,000
un River	312,000	3,270,000
ale and Owyhee	1,730,000	14,878,000
akima	18,707,000	157,683,000
uma	2,452,000	19,853,000
Total	68,206,000	525,435,000

In addition to the above-estimated tax revenue an appropriate hare of corporation income taxes, excise and other Federal taxes re directly and indirectly related to the business and industrial activity in these areas. As an example the rough estimates for Maricopa County, Ariz., representing the Salt River project area include $23,552,000 of corporation taxes and $18,315,000 of other miscellaneous tax revenues, bringing the estimated total Federal tax revenue from the area to about $65,000,000.

For the 15 projects for which estimates were made, the individual income taxes of $525,000,000 plus about $250,000,000 of corporation tax revenues bring the total to approximately $750,000,000 since development of the areas. By projecting this total to the 62 irrigation projects now in production, estimates on total Federal tax payments can be secured. These estimates indicate that, since Federal income taxes were initiated, approximately 1.55 billion dollars of individual income taxes and about 2.3 billion dollars of all Federal taxes have been paid from all Reclamation project areas receiving either a full or supplemental water supply from Federally constructed works.

Purchasing Power

Two Reclamation project areas will serve as examples to demonstrate purchasing power created by reclamation activity. In 1949 approximately 40 percent of the volume and 72 percent of the value of all railroad shipments of freight into Ada and Canyon Counties were from the 37 States east of the Rocky Mountains. From 1939 to 1949 the volume increased from about 2,200 to more than 8,235 carloads and the value increased from 6.5 million to 92.2 million dollars. For every carload of freight shipped out of the area in 1949 one carload was shipped into the area. The in-shipments totaled 20,476 cars valued at 127.6 million dollars and the out-shipments amounted to 21,403 cars valued at 50.7 million dollars. Truck freight shipped in would increase these figures by about one-fourth. Thus the total in and out shipments in 1949 approximate an equivalent of about 52,000 cars valued at 223 million dollars.

The Scottsbluff area of the North Platte project in Nebraska received 283 carloads of freight in 1900. With the development of irrigation in the area these in-shipments increased to 1,447 carloads in 1910; 6,207 in 1940; and 7,144 in 1942. In this area the freight shipped in is more than twice the volume shipped out of the area.

The value of retail sales provides another excellent clue to the relationship of the West to the Nation. In 1949 alone, in the 17 Western States they amounted to nearly 34 billion dollars. An analysis of railroad carloadings, as previously indicated, shows that a very high percentage of this merchandise was shipped into the West from the industrial centers of the Midwest and the East. In terms of the international market in which we as a Nation seek to stimulate trade, the value of retail sales in the 17 Western States exceeds total United States exports by 3 times. Retail sales in the three far Western States exceed the total value of United States exports by 20 percent.

The deposits in banks which directly service Reclamation areas have been constantly increasing and for the last 5 years have averaged more than a billion dollars a year. In 1950 deposits were up to approximately 1.1 billion and are expected to increase in future years.

Land Openings

During the fiscal year of 1951 the Bureau opened for sale and settlement 4,257 acres of irrigable land on the Columbia Basin project comprising 106 farm units. These openings included 30 units consisting of 2,505 acres in the East Columbia Irrigation District and 20 units involving 1,634 acres in the Quincy Columbia Basin Irrigation District. In addition to these openings which were full-time farming opportunities the Bureau opened 56 part-time units in the Burbank Pumping Unit with a total acreage of 118. All farms were located on the Columbia Basin project in the State of Washington.

A large portion of the irrigation facilities now under construction or scheduled for future construction by the Bureau will serve privately owned lands. However, during fiscal year 1952 about 25,000 acres of public or government acquired lands on Reclamation projects are scheduled to be opened for settlement. These lands scheduled for settlement in 1952 are located on the Columbia Basin, Gila, All-American Canal, and Riverton projects.

The farm units opened for settlement on the Columbia Basin project during the past year were composed primarily of government-acquired land and were sold to settlers under the provisions of the Columbia Basin Project Act rather than being disposed of through homesteading. Veterans of World War II were given preference in the purchase of these units. The demand for farm units still continues to exceed the supply as indicated by the 1,683 applications which were received for 50 full-time farm units on the Columbia Basin project or an average of 33 applications per farm unit. Thus where 1 veteran succeeded in obtaining a unit 32 were unsuccessful.

Fifty-six of the units offered for sale on the Columbia Basin project were part-time farm units ranging in size from one-half to five irrigable acres. This is the first time that part-time farm units have been offered for settlement on Reclamation projects.

These part-time farm units are intended primarily for persons who obtain income from other sources but who desire a rural residence where they can obtain part of their living from the farm.

The units were established in accordance with the recommendations made in the Columbia Basin Joint Investigations. These investigations or studies as they are frequently referred to were conducted by the Bureau of Reclamation in cooperation with members of Federal, State, and local agencies, along with authorities from universities and other walks of life in order to encourage the success of settlers on the project. The entire study, designed to assist new settlers in every phase of reclamation, is the most extensive and informative ever undertaken in connection with an irrigation development and today is world renowned for its value to those interested in irrigation farming.

One public land drawing was held during the year for the award of 54 farm units, consisting of 6,940 acres on the Riverton project in Wyoming. The public announcement for these farms was issued on March 28, 1950, and the last day for filing was June 26, 1950, while the actual drawing was held on August 26, 1950.

Settler Assistance

The Bureau has extended its continuing program to obtain technical assistance for new settlers on Reclamation projects through cooperation with State Colleges and agencies of the Department of Agriculture. The Bureau now has in effect nine working agreements with State Colleges in Idaho, Kansas, Oklahoma, Oregon, Montana, New Mexico, Washington, and two in Wyoming for helping settlers to get off to a good start on their new farms. The State Colleges of Agriculture have employed assistant county agents to give special counsel to the newcomers. In other cases the various agricultural agencies, which are able to grant specific service to the settlers, have jointly formed a settler-assistance program and have mutually agreed on the individual aid each will give to the farmers.

Development farms.—Eleven development farms have been established in connection with this program. They are Bostwick, Nebraska, in the Bostwick division of the Missouri River Basin project; Burbank, Burke, Pasco, and Winchester in Washington; Huron and Redfields in South Dakota; Bowbells and Mandan in North Dakota; Kanopolis in Kansas; and Riverton in Wyoming. These farms are located in new project areas, namely, Columbia Basin, Missouri Basin, and Riverton, which are being brought under irrigation primarily to demonstrate approved methods of irrigation and cultural practices best adapted to specific localities.

A part of each farm generally is reserved for use by the State experimental station and agencies of the United States Department of Agriculture for conducting research. The findings of this research are made available to settlers in this area and are also demonstrated on the development farms. Field days and tours are conducted on the development farms. Some of these farms have been in operation for three or more years. During the past year new farms were established on the Columbia Basin, Missouri Basin, and Riverton projects. Several additional development farms are scheduled for the Missouri Basin project within the next 2 years.

Credit for settlers.—Limited finances continue to be a problem for new settlers, even though during the past year a great deal of progress has been made to remedy this situation. Under provisions of Public Law 361, Eighty-first Congress, it is now possible for the Farmers Home Administration of the Department of Agriculture to make loans to settlers on public land previous to the time they receive patent to the land. Under the provisions of this law, the Farmers Home Administration has made loans to a relatively large percentage of new settlers on Reclamation projects, and as a result these farmers have made rapid progress in developing their farm units. As an example, the 104 settlers on the Heart Mountain Division of the Shoshone project in Wyoming who obtained farm units late in 1949 had an average of over 70 percent of their land under cultivation in the fall of 1950. Excellent cooperation exists between the Farmers Home Administration and the Bureau of Reclamation and the Bureau works closely with the Administration in estimating the needs of that agency for funds for loan purposes.

The settler application for a loan must be approved by the local Farmers Home Administration Board. Also the money must be available in the Farmers Home Administration which is dependent upon annual Congressional appropriations.

Cooperation with other agencies.—The Bureau of Reclamation is continuing its policy of obtaining technical information and assistance in the agricultural and economic phases of its program through cooperation with state colleges of agriculture and agencies of the United States Department of Agriculture. In this connection the Bureau now has in effect 41 memoranda of understanding or cooperative agreements with state colleges and other agencies. These agreements provide for a wide range of activities including research on the agricultural, economic, or engineering phases of reclamation, service to the Bureau, and joint efforts in the solution of problems. An example is the agreement between the Washington State College, the Soil Conservation Service, and the Bureau of Reclamation which provides for the conducting of investigations on the Columbia Basin project to develop technical standards and practical irrigation guides to be used in advising and assisting settlers in efficient use of irrigation water on that project. As a result of these investigations, standards and guides will be prepared for the use of settlers and also for use of the several agricultural agencies in their assistance to settlers.

Another example is the memorandum of understanding between the Washington State College, the Farmers Home Administration, and the Bureau of Reclamation which provides for the Bureau's collaboration with the Farmers Home Administration and the State College Extension Service in preparing plans for a domestic water system for each irrigation block in the Columbia Basin project. The Extension Service will then conduct educational work and will, if necessary, help to perfect organizations of landowners which can assume financial obligations for domestic water systems. The Farmers Home Administration will work with individuals or organizations to achieve the development of domestic water systems as planned. The Administration will also take steps to finance such construction insofar as available funds permit.

Lower Cost Canal-Lining Program

This special-investigations program, aimed at a determination of materials, methods, and procedures that will result in the most economical canal linings, was initiated in 1946. The investigations have included laboratory work in Denver and experimental field installations throughout the West. The work was continued during the past year by the Bureau of Reclamation directly and by utilization of the resources and experience of State colleges and the Soil Conservation Service, in cooperative studies.

Utilization of the findings and developments under this program in design and construction of new projects and in rehabilitation and betterment of older, existing projects has resulted in definite worthwhile savings to the Government.

Progress during the first 2 years of the investigations was recorded in a general information report titled "Lower Cost Canal Linings," dated June 1948. It is anticipated that a complete, revised report of accomplishments to date will be issued early in fiscal year 1952. The following items are representative of these accomplishments:

1. Liberalization and simplification of specification requirements with respect to line, grade, and finish of hard-surface linings have encouraged greater mechanization of placing equipment and resulted in lower construction costs and lower bid prices.
2. Elimination of reinforcement steel in concrete linings, except where safety is involved, has resulted in savings of 10 to 15 percent in total cost.
3. Development of subgrade-guided slip-forms has made it economically feasible to line small canals and laterals with hard-surface linings which heretofore have been prohibitive in cost.
4. Development of a buried asphalt membrane lining which may be constructed of prefabricated strips or hot sprayed-in-place asphalt cement, covered with a protective blanket of earth or gravel, has resulted in greatly reduced costs where its use is applicable.

Drainage

During the past year, investigations of drainage problems were intensified. The branches of Project Planning, Design and Construction, and Operation and Maintenance cooperated to make sure that in the planning stage proper consideration was given to potential drainage problems, that programs were provided or reestablished to assist operating projects in making water-table observations, and that the design and construction of drainage works were properly supervised. Drainage is one of the important items in the Rehabilitation and Betterment program and it is hoped that on the existing projects, where drainage systems are necessary and feasible but are beyond the ability of the water users to finance in regular Operation and Maintenance assessments, they will be cleared up in the next few years.

Weed Control

The comprehensive program of weed control and research now being conducted has resulted in material savings in operating problems, maintenance costs, and water losses. The development of aromatic solvents for the control of waterweeds has saved many thousands of dollars annually. The use of 2,4-D has been instrumental in helping solve the serious willow problem on ditchbanks as well as noxious perennial and annual weeds. The new herbicide TCA (Trichloroaceate) is helping eliminate weedy grasses.

An educational program is conducted for project operators to teach he most effective and economical methods. A handbook which decribes these methods has been written and distributed to both Federal and private irrigation projects. Requests for the book have been received from 21 foreign countries. In the spring of 1951 a motion picture "Weed Control on Irrigation Systems" and a slide lecture on he same subject were completed. These have been in great demand.

The Department of the Interior Weed Control Committee has been nstrumental in the formation of a similar committee in the Department of Agriculture. The two committees hold bimonthly meetings to exchange information on weed-control methods and to discuss common problems. They also help coordinate weed-control programs being conducted by land management agencies with the general aim of preventing duplication of activities.

The grass-planting program on ditchbanks has been continued to prevent future weed problems and to furnish extra pasture for project farmers livestock. Grasses have been found to absorb less water than broadleaved weeds, they prevent erosion of ditchbanks and are excellent weed competitors. A systematic program of seeding grasses has been formulated with the aim of establishing a grass sod on all projects where growing conditions are favorable. Maintenance costs and water losses due to weeds have been reduced to a minimum where this practice has been established. On new projects seeding is begun as soon as possible after construction.

Two problems which need further study are the control of salt cedar and cattails. The program of cooperative research with the Bureau of Plant Industry, Soils, and Agricultural Engineering is being continued at its four weed-control field stations in the irrigated West. The basic research is conducted at the weed-control laboratory of the Chief Engineer's office in Denver where a BPISAE plant physiologist works with Bureau of Reclamation chemists and weed specialists. As a result of this cooperation several promising methods of solving these remaining problems have been indicated but further investigation will be necessary before practical applications can be developed.

Sprinkler Irrigation

Field investigations of sprinkler irrigation methods and results under actual farming conditions were continued on the Columbia River Basin project in Washington, on the Missouri River Basin project in North Dakota, and on the Gila project in Arizona.

Final conclusions regarding the applicability of sprinkler irrigation have not been reached. In some instances, sprinkling will be the best or perhaps the only feasible method of water application. Results to date continue to indicate, however, that surface irrigation is more economical on lands adapted to the use of surface methods.

Soil and Moisture Conservation Operations

Under the Bureau's program of soil and moisture conservation operations, efforts were continued on the control of erosion on public lands under the jurisdiction of the Bureau, protection of reservoirs, canals, and other irrigation works from siltation, and prevention of water losses detrimental to irrigation projects.

This work is accomplished throughout the 17 Western States by individual effort of the Bureau of Reclamation and through effective cooperation with all other interested agencies in each of the areas concerned, particularly with the Bureau of Land Management, the Bureau of Indian Affairs, the Forest Service, the Soil Conservation Service, and Soil Conservation Districts.

With greater Congressional recognition of the importance of this phase of the Bureau's operations, appropriations have been increased, permitting a more effective attack on the soil and water loss problems with which we are confronted. Representative of these activities are the stabilization and conservation of public lands in reservoir areas of the Central Valley project through revegetation, structures, etc., the cooperative program with the Bureau of Land Management for control of erosion in the Book Cliffs area, Colorado, for benefit of public land and protection of Reclamation structures of the Grand Valley project; construction for control of erosion for protection of the main canal and structures of the Rio Grande project; and increased construction for prevention of further erosion of Five Mile and Muddy Creeks above the Boysen Reservoir in Wyoming.

Payments to School Districts

The act of June 29, 1948 (Public Law 835) authorized the Secretary of the Interior to make such provision as may be deemed necessary and in the public interest for the education of dependents of persons employed by the Bureau of Reclamation on projects and investigations.

At the close of the fiscal year, cooperative agreements covering school assistance were executed by the Bureau of Reclamation with the following school districts under the provisions of Public Law 835: Swan Valley No. 92, Idaho (Palisades project); Rural School District No. 9, Crook County, Wyo. (Keyhole Dam); Trenton School District No. 11, Hitchcock County, Nebr. (Trenton Dam); Anderson Dam

School District, Idaho (Boise project); Colorado School District No. 8, (Platoro Dam), San Luis Valley project, Colorado; Grant County School District No. 156, Washington (Columbia Basin project); Grade School District No. 1, Cheyenne County, Kans. (St. Francis unit, Missouri River Basin project); Gustine Union Elementary School District, California (Central Valley project); York Consolidated School District No. 33, Lewis and Clark County, Mont.; and Superior School District No. 11, Nebraska (Bostwick Division, Missouri River Basin project).

In addition to the assistance given through the cooperative agreement under Public Law 835 maximum tuition payments of $65 per semester were authorized for the fiscal years 1948–51 for dependents of any Federal employee living in the vicinity of Boulder City, Nev., under the provisions of the act of May 14, 1948 (Public Law 528).

The Eighty-first Congress by recognizing the need for an equitable and uniform Federal school assistance policy passed legislation which placed all school assistance measures in federally affected areas with the Office of Education. Public Law 815, relating to construction of school facilities in federally affected areas, and Public Law 874, concerning operation and maintenance of schools in such areas were approved September 23 and September 30, 1950, respectively. These laws provide that funds appropriated to other Federal agencies for the same purpose in fiscal year 1951 were to be available for transfer to the Commissioner of Education. A detailed statement of the Bureau's school assistance program was furnished the Commissioner of Education. In accordance with a Statement of Principles in connection with Public Law 874, issued by the Commissioner of Education, the Bureau of Reclamation was authorized to continue to execute contracts for school operation and maintenance during fiscal year 1951 in cases in which an agreement or understanding for such assistance had been reached prior to the passage of Public Law 874. Also, the Bureau was encouraged to complete all school construction activities undertaken under Public Law 835 where such construction contract was let prior to the enactment of Public Law 815, Eighty-first Congress. In any of the above school situations, the Commissioner of Education has agreed not to institute claim for reassignment of funds appropriated to the Bureau for fiscal year 1951. Public Law 874 and Public Law 815 also provide that funds shall not be available to other Federal agencies after June 30, 1951, for the same purposes as these acts. Accordingly, the Bureau of Reclamation will not provide future financial assistance under Public Law 835 or Public Law 528 after the close of the fiscal year. However, the Bureau has requested funds for fiscal year 1952 to complete the construction of school facilities at Boulder City, Nev., undertaken in previous year.

Recreational Use of Reservoirs

Construction of dams and reservoirs for irrigation and power development provides incidental but very definite benefits to the public through the creation of exceptional recreational opportunities. This is particularly true in the more arid parts of the West.

Except in the Missouri River Basin, the Bureau of Reclamation is not authorized to expend funds for recreational development of reservoir areas. At certain reservoirs where recreational possibilities are deemed to be of national significance, such as Lake Mead, on the Colorado River between Arizona and Nevada; Franklin D. Roosevelt Lake, on the Columbia River in Washington; Millerton Lake, on the San Joaquin River in California, and Shadow Mountain and Granby Lake on the Colorado River in Colorado, the development and administration of recreational facilities is handled for the Bureau by the National Park Service. At certain other reservoirs which are located within National Forest boundaries, recreational facilities are administered by the United States Forest Service.

There is an urgent need for legislation to provide authorization for the expenditure of nonreimbursable funds for the coordinated planning, development, and administration of the recreational resources at Reclamation dams and reservoirs.

During the past year, the Bureau of Reclamation also worked closely with the Fish and Wildlife Service and with the various State fish and game agencies for the protection and, where possible, enhancement of fish and wildlife values at reservoirs and on project lands. A joint report was prepared with the Fish and Wildlife Service with recommendations for maintenance and further development of the San Joaquin River "Grasslands" in California, as a part of the Pacific flyway for migratory waterfowl. Agreement was also reached with the Service concerning improvement of the Lake Havasu National Wildlife Refuge, which embraces all of the reservoir formed by Parker Dam on the lower Colorado River.

POWER UTILIZATION

A new record of achievement in hydroelectric power capacity and production on multipurpose projects constructed by the Bureau of Reclamation was accomplished during fiscal year 1951.

By June 30, 1951, the total installed capacity in power plants constructed and operated by the Bureau of Reclamation was 3,939,500 kilowatts, the highest installation achieved by the Bureau of Reclamation. The sales of electric energy during the fiscal year totaled approximately 21,265,000,000 kilowatt-hours which brought in revenues of about $35,100,000 to the Treasury. During fiscal year 1951, 771,100 kilowatts were added in Bureau power plants. Additional capacity scheduled to be added in fiscal year 1952 will further increase power production capacity by 339,200 kilowatts. A summary of power sales and revenues by projects is shown in table 7.

Table 7.—*Bureau of Reclamation power systems, power sales, and revenues by projects, fiscal year ending June 30, 1951* [1]

Project	Sales of electric energy kilowatt-hours	Revenues from sales of electric energy
Region 1:		
Boise	97, 153, 285	$127, 334
Columbia Basin	12, 779, 950, 200	8, 175, 979
Minidoka	115, 199, 254	453, 257
Yakima	23, 878, 092	62, 161
Region 2: Central Valley	2, 421, 761, 898	10, 510, 893
Region 3:		
Boulder Canyon	4, 311, 603, 775	8, 628, 005
Parker-Davis	718, 510, 192	2, 510, 928
Yuma	8, 687, 718	38, 423
Region 5: Rio Grande	64, 935, 913	407, 421
Region 6:		
Fort Peck	263, 825, 355	934, 145
Riverton	32, 927, 249	200, 381
Shoshone	68, 388, 584	417, 416
Region 7:		
North Platte	47, 788, 918	499, 462
Kendrick	143, 983, 754	919, 304
Colorado-Big Thompson	139, 839, 101	1, 051, 822
Missouri River Basin	26, 924, 913	189, 079
Total	21, 265, 358, 201	35, 126, 010

[1] Does not include energy sales and revenues in transactions between Bureau projects.

Although previous records of capacity and annual generation were surpassed with the record installation of generating capacity in power plants on Reclamation multipurpose projects, demands for electric power still exceeded the available supply. Applications for power service continued to mount and contracts for sale of energy are being processed in great numbers to provide for the widespread distribution and integrated use of power to be produced from plants now under construction.

The impact of the Korean War has brought about new demands for power from industry and from rural areas. Many applications for large blocks of power for use by industries have been received by the Bureau of Reclamation but many of these demands could not be met because the present power production is fully utilized and much of the future production is committed.

Expansion of rural electrification is still a major factor contributing to the increasing power requirements in many areas, particularly in Missouri River Basin States. Shortages of power in North and South Dakota and other areas of the West have delayed extension of rural lines.

This critical situation will be partially alleviated in North and South Dakota by the advance construction of portions of the ultimate Missouri River Basin project power system. Initially, these portions will be utilized to serve rural loads from presently available sources and from fuel generating plants under construction by Rural Electrification Administration financed generating plants. When Garrison and Fort Randall power plants are brought into production in 1953 and 1954 by the United States Army Corps of Engineers, these transmission lines will then be used to market this power to preference customers and the hydroelectric generating plants will be integrated with existing plants in the areas. The advance construction of these lines have been authorized by the Congress, and it is recognized that this will have an important influence in delivering power to rural customers in these areas at an early date. Ultimately, the transmission systems in North and South Dakota will be extended to cover a much greater area and deliver power from the federally constructed plants to a great number of consumers.

Wheeling arrangements, whereby Reclamation power is transmitted over the lines of private utilities, constitute another significant factor in the utilization of Federal electric power output to a maximum of capability. Such arrangements have been consummated with a number of private utilities in the West. Through these, existing utility transmission line capacity is utilized to the maximum for serving areas at an early date or at a more economical cost to the Government.

In many instances, it has been possible by wheeling and power interchange arrangements to provide power to preference customers, especially Rural Electrification Administration cooperatives and municipalities, well in advance of the time when service can be made available to them by construction of Reclamation project transmission systems. Such arrangements also permit delivery of power to areas many miles from Reclamation project power plants and well beyond economical transmission distance. Thus the maximum utilization of existing facilities is obtained by displacement.

Irrigation pumping, which is vital to some Reclamation projects, continues to impose large demands upon Reclamation power systems. Pumping of irrigation water at Grand Coulee Dam in Washington is essential to the Columbia Basin project irrigation plant. On the Central Valley project, the Tracy pumping plant lifts a tremendous quantity of water to permit irrigation of many additional acres of highly productive agricultural land.

The Bureau of Reclamation is continuing to plan the development of power consistent with multipurpose development of the West's valuable water resources.

Present Installed Capacity

The installed nameplate capacity of 3,939,500 kilowatts in the 23 power plants operated by the Bureau of Reclamation at the end of fiscal year 1951 showed an increase of 771,100 kilowatts capacity over the 1950 fiscal year figure. The increase resulted from the addition of four generating units of 108,000 kilowatts each, and one station service unit of 10,000 kilowatts at Grand Coulee power plant on the Columbia River Basin project in Washington; two units of 13,500 kilowatts each at Anderson Ranch power plant on the Boise-Anderson Ranch project in Idaho; five units of 45,000 kilowatts each at Davis Dam project in Arizona and California; three units of 15,000 kilowatts each at the Estes power plant on the Colorado-Big Thompson project; one unit of 8,100 kilowatts' capacity at the Marys Lake power plant on the Colorado-Big Thompson project; two units of 12,000 kilowatts each at the Kortes power plant in Wyoming on the Missouri River Basin project. By these installations five power plants were completed during the 1951 fiscal year. These power plants were—

(1) Anderson Ranch on the Anderson Ranch-Boise project in Idaho;

(2) Davis on the Davis Dam project in Arizona and California;

(3) Estes on the Colorado-Big Thompson project in Colorado;

(4) Marys Lake on the Colorado-Big Thompson project in Colorado;

(5) Kortes on the Missouri River Basin project in Wyoming.

Power plants operated by other agencies, principally water users' organizations, on Reclamation projects totaled 16, of which 9 were originally constructed by the Bureau of Reclamation. These nine plants have an installed capacity of 30,827 kilowatts; the seven other plants constructed by the water users' organizations have an installed capacity of 72,500 kilowatts.

Initial operation of the 225,000-kilowatt power plant at Davis Dam in January 1951 was the most significant event concerning new hydroelectric power development during fiscal year 1951. The addition of four generating units at Grand Coulee power plant on the Columbia Basin project in Washington brought the total installed capacity to a world record of 1,866,000 kilowatts for a hydroelectric plant.

Additional Capacity Under Construction

At the end of fiscal year 1951 the Bureau of Reclamation had under construction 10 new power plants which will have an ultimate installed capacity of 680,450 kilowatts. In addition, construction of two 82,500-kilowatt units and one 50,000-kilowatt unit for Hoover powe plant on the Boulder Canyon project was continuing. One mor generating unit which is now being installed remained to be place into operation at Grand Coulee power plant.

New power plants under construction include Folsom and Nimbu with a combined capacity of 167,000 kilowatts in California on th Central Valley project; Flatiron with a capacity of 63,000 kilowatt and Polehill with a capacity of 33,250 kilowatts, both on the Colorado Big Thompson project in Colorado; Hungry Horse power plant wit a capacity of 285,000 kilowatts in Montana; Angostura and Canyo Ferry with capacities of 1,200 and 50,000 kilowatts, respectively, o the Missouri River Basin project in Montana; Boysen power plan with a capacity of 15,000 kilowatts on the Missouri River Basin projec in Wyoming, and Eklutna power plant with a capacity of 30,000 kilowatts on the Eklutna project in Alaska where preliminary construction is underway. United States Army Corps of Engineers is proceeding ahead of schedule with the construction of Garrison powe plant, with a capacity of 400,000 kilowatts in North Dakota, and th Fort Randall power plant with a capacity of 320,000 kilowatts in Sout Dakota, both on the Missouri River Basin project. The United State Army Corps of Engineers also is proceeding with preliminary construction at the Oahe Dam where a power plant with a capacity o 425,000 kilowatts is scheduled on the Missouri River Basin project i South Dakota. The Bureau of Reclamation will market the powe from the plants of the United States Army Corps of Engineers i the Missouri River Basin over transmission lines that are constructe on the project.

Authorized to be constructed by the Bureau of Reclamation ar 22 power plants with a total capacity of 927,000 kilowatts. Th United States Army Corps of Engineers have an additional 220,00 kilowatts authorized for construction in Big Bend and Gavins Poin power plants on the Missouri River Basin project in South Dakota.

The status of hydroelectric power plants on Reclamation projects i operation, under construction, or authorized, is shown in table 8.

Transmission Lines

By June 30, 1951, it is estimated that the Bureau of Reclamatio had about 6,260 miles of high voltage transmission lines in operation This was accomplished by the completion of about 1,740 miles of lin

CONSTRUCTED AND OPERATED BY BUREAU OF RECLAMATION

State	Project	Name of plant	Calendar year of initial operation	Existing nameplate capacity (kilowatts)	Ultimate nameplate capacity (kilowatts)	Number of existing generators and capacities (kilowatts)	Ultimate number of generators and capacities (kilowatts)
Arizona-Nevada	Boulder Canyon	Hoover [1]	1936	1,034,800	1,332,300	12-82,500; 1-40,000; 2-2,400	15-82,500; 1-40,000; 1-50,000; 2-2,400.
Do	Davis Dam	Davis	1951	225,000	225,000	5-45,000	5-45,000.
Arizona-California	Parker	Parker	1942	120,000	120,000	4-30,000	4-30,000.
California	Central Valley	Keswick	1949	75,000	75,000	3-25,000	3-25,000.
Do	do	Shasta	1944	379,000	379,000	5-75,000; 2-2,000	5-75,000; 2-2,000.
Do	Yuma	Siphon Drop	1926	1,600	1,600	2-800	2-800.
Colorado	Colorado-Big Thompson	Estes	1950	45,000	45,000	3-15,000	3-15,000.
Do	do	Green Mountain	1943	21,600	21,600	2-10,800	2-10,800.
Do	do	Marys Lake	1951	8,100	8,100	1-8,100	1-8,100.
Idaho	Boise	Anderson Ranch	1950	27,000	[2] 40,500	2-13,500	3-13,500.[2]
Do	do	Black Canyon	1925	8,000	8,000	2-4,000	2-4,000.
Do	do	Boise Diversion	1912	1,500	1,500	3-500	3-500.
Do	Minidoka	Minidoka	1909	13,400	13,400	1-5,000; 1-2,400; 5-1,200	1-5,000; 1-2,400; 5-1,200.
Wyoming	North Platte	Guernsey	1927	4,800	4,800	2-2,400	2-2,400.
Do	do	Lingle	1919	1,400	1,400	2-400; 2-300	2-400; 2-300.
New Mexico	Rio Grande	Elephant Butte	1940	24,300	24,300	3-8,100	3-8,100.
Washington	Columbia	Grand Coulee [3][4]	1941	1,866,000	1,974,000	17-108,000 [4]; 3-10,000	18-108,000 [4]; 3-10,000.
Do	Yakima	Prosser [6]	1932	2,400	[6] 2,400	1-2,400	1-2,400.
Wyoming	Kendrick	Seminoe	1939	32,400	32,400	3-10,800	3-10,800.
Do	Missouri River Basin	Kortes	1950	36,000	36,000	3-12,000	3-12,000.
Do	Riverton	Pilot Butte	1925	1,600	1,600	2-800	2-800.
Do	Shoshone	Heart Mountain	1948	5,000	5,000	1-5,000	1-5,000.
Do	do	Shoshone	1922	5,600	5,600	1-4,000; 2-800	1-4,000; 2-800.
Subtotal A				3,939,500	4,358,500		

CONSTRUCTED BY BUREAU OF RECLAMATION: OPERATED BY OTHERS

State	Project	Name of plant	Calendar year of initial operation	Existing nameplate capacity (kilowatts)	Ultimate nameplate capacity (kilowatts)	Number of existing generators and capacities (kilowatts)	Ultimate number of generators and capacities (kilowatts)
Arizona	Salt River	Arizona Falls [7]	1913	850	850	2-425	2-425.
Do	do	Cross Cut [7]	1914	5,100	5,100	1-3,000; 3-700	1-3,000; 3-700.
Do	do	Roosevelt	1909	15,400	15,400	5-1,080; 1-4,000; 1-6,000	5-1,080; 1-4,000; 1-6,000.
Do	do	Southern Consolidated [7]	1912	5,600	1,600	2-800	2-800.
Colorado	Grand Valley	Grand Valley (Palisades)	1932	3,000	3,000	2-1,500	2-1,500.
Nevada	Newlands	Lahontan	1911	1,640	1,640	1-640; 2-500	1-640; 2-500.
Oregon	Dechutes	Cove [8]	1946	1,500	1,500	1-1,500	1-1,500.
Utah	Strawberry Valley	Spanish Fork [9]	1908	1,550	1,550	2-450; 1-250; 1-400	2-450; 1-250; 1-400.
Washington	Yakima	Rocky Ford	1916	187	187	1-187	1-187.
Subtotal B				30,827	30,827		

See footnotes at end of table.

Table 8.—*Hydroelectric plants on Reclamation projects—operating, under construction, or authorized as of June 30, 1951*—Con.

CONSTRUCTED AND OPERATED BY WATER USERS ORGANIZATIONS

State	Project	Name of plant	Calendar year of initial operation	Existing nameplate capacity (kilowatts)	Ultimate nameplate capacity (kilowatts)	Number of existing generators and capacities (kilowatts)	Ultimate number of generators and capacities (kilowatts)
Arizona	Salt River	Chandler [10]	1919	600	600	1-600	1-600.
Do	do	Horse Mesa [10]	1927	30,000	30,000	3-10,000	3-10,000.
Do	do	Mormon Flat [10]	1926	7,000	7,000	1-7,000	1-7,000.
Do	do	Stewart Mtn. [10]	1930	10,400	10,400	1-10,400	1-10,400.
California	All-American	Drop No. 3 [11]	1941	4,800	9,600	1-4,800	2-4,800.
Do	do	Drop No. 4 [11]	1941	19,200	19,200	2-9,600	2-9,600.
Oregon	Klamath	"C" Canal Drop [12]	1938	500	500	1-500	1-500.
Subtotal C				72,500	77,300		
CONSTRUCTED AND OPERATED BY CORPS OF ENGINEERS, DEPARTMENT OF THE ARMY: POWER MARKETED BY BUREAU OF RECLAMATION							
Montana	Fort Peck	Fort Peck	1943	50,000	105,000	1-35,000; 1-15,000	3-35,000.
Subtotal D				50,000	105,000		
UNDER CONSTRUCTION BY BUREAU OF RECLAMATION							
Alaska	Eklutna	Eklutna	1954	0	30,000	0	3-10,000.
California	Central Valley	Folsom	1954	0	162,000	0	3-54,000.
Do	do	Nimbus	1954	0	5,000	0	1-5,000.
Colorado	Colorado-Big Thompson	Flatiron	1953	0	63,000	0	2-31,500.
Do	do	Polehill	1953	0	33,250	0	1-33,250.
Montana	Missouri River Basin	Angostura	1951	0	1,200	0	1-1,200.
Do	do	Canyon Ferry	1953	0	50,000	0	3-16,666.
Do	Hungry Horse	Hungry Horse	1952	0	285,000	0	4-71,250.
Wyoming	Kendrick	Alcova	1954	0	36,000	0	2-18,000.
Do	Missouri River Basin	Boysen	1952	0	15,000	0	2-7,500.
Subtotal E				0	680,450		
UNDER CONSTRUCTION BY CORPS OF ENGINEERS, DEPARTMENT OF THE ARMY: POWER TO BE MARKETED BY BUREAU OF RECLAMATION							
North Dakota	Missouri River Basin	Garrison	1955	0	400,000	0	5-80,000.
South Dakota	do	Fort Randall	1953	0	320,000	0	8-40,000.
Subtotal F				0	720,000		

AUTHORIZED TO BE CONSTRUCTED BY BUREAU OF RECLAMATION

Colorado	Colorado-Big Thompson	Big Thompson		0	6,700	0	1-6,700.
Idaho	Minidoka	American Falls	1953	0	30,000	0	4-7,500.
Do	Palisades	Palisades	1957	0	112,500	0	5-22,500.
Montana	Missouri River Basin	Kenil	1959	0	1,600	0	2-800.
Do	do	Little Porcupine	1955	0	18,000	0	3-6,000.
Do	do	Lyon	1960	0	24,000	0	3-8,000.
Do	do	Absaraka	1961	0	50,000	0	3-16,667.
Do	do	Portage	1960	0	20,000	0	2-10,000.
Do	do	Tiber	1956	0	2,000	0	3-667.
Do	do	Yellowtail	1956	0	200,000	0	4-50,000.
Nebraska	do	Harlan		0	1,200	0	1-1,200.
North Dakota	do	Crosby		0	48,000	0	6-8,000.
Do	do	Des Lacs		0	60,000	0	6-10,000.
South Dakota	do	Pony Hills	1961	0	180,000	0	4-45,000.
Utah	Weber Basin	Gateway	1955	0	4,000	0	
Washington	Yakima-Kennewick Division	Chandler	1953	0	12,000	0	2-6,000.
Do	Yakima-Roza Division	Roza	1954	0	10,000	0	2-5,000.
Wyoming	Missouri River Basin	Bald Ridge	1961	0	30,000	0	3-10,000.
Do	do	Hunter Mountain	1962	0	12,000	0	2-6,000.
Do	do	Sunlight	1960	0	20,000	0	2-10,000.
Do	do	Thief Creek	1960	0	60,000	0	3-20,000.
Do	do	Tongue River	1961	0	25,000	0	2-12,500.
Subtotal G				0	927,000		

AUTHORIZED TO BE CONSTRUCTED BY CORPS OF ENGINEERS, DEPARTMENT OF THE ARMY: POWER TO BE MARKETED BY BUREAU OF RECLAMATION

South Dakota	Missouri River Basin	Big Bend	1960	0	120,000	0	6-20,000.
Do	do	Gavins Point	1956	0	100,000	0	3-33,333.
Do	do	Oahe [5]		0	425,000	0	5-85,000.
Subtotal H				0	645,000		
Total				4,092,827	7,544,077		

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[1] Power plant units operated by power allottees under agency contract.

[2] 27,000 kilowatts authorized; space provided in plant for third unit.

[3] Power marketed by Bonneville Power Administration.

[4] Main units with a nameplate rating at 108,000 kilowatts have continuous operating capacity of 120,000 kilowatts.

[5] Preliminary construction work under way.

[6] Prosser will be removed when Chandler is constructed.

[7] Powerplant constructed by Bureau of Reclamation with Salt River Valley Water Users' Association funds.

[8] Unit No. 3 installed in Pacific Power and Light Co.'s Cove No. 2 plant.

[9] Three plants: (a) Spanish Fork (upper); (b) Spanish Fork (lower); (c) Payson.

[10] Salt River Valley Water Users' Association's plant.

[11] Imperial Irrigation District's plant.

[12] Enterprise Irrigation District's plant.

during the 1951 fiscal year. Principal lines placed in operation during the year were as follows:

Project and line	Voltage (kilovolts)	Completed	Length
Boise-Anderson Ranch (Idaho): Anderson Ranch power plant to Mountain Home substation.	115	December 1950	17.9
Central Valley (California):			
Oroville Junction to Tracy	230	May 1951	129.0
Tracy to Contra Costa	69	June 1951	26.0
Davis Dam (Arizona-California):			
Davis Dam power plant to Prescott to Mesa to Coolidge	230	January 1951	278.6
Davis Dam power plant to Basic Magnesium plant tap	230	January 1951	63.9
Davis Dam power plant to Parker Dam power plant	230	January 1951	69.9
Coolidge to ED-5 substation	115	January 1951	30.7
Tucson to Cochise	115	January 1951	79.4
Parker Dam power plant to Blythe to Pilot Knob	161	January 1951	129.0
Gila to Wellton to Mohawk	34.5	May 1951	21.1
Palisades (Idaho): Palisades Dam to Goshen	115	August 1950	47.7
Rio Grande (New Mexico): Hot Springs tap line	115	March 1950	1.5
Colorado-Big Thompson (Colorado):			
Flatiron switchyard to Pole Hill power plant	115	July 1950	5.0
Estes power plant to Flatiron switchyard	115	September 1950	16.3
Flatiron switchyard to Greeley substation	115	September 1950	26.9
Brush substation to Yuma substation	115	October 1950	51.0
Flatiron switchyard to Leyner substation	115	December 1950	25.0
Leyner substation to Brighton substation	115	December 1950	14.0
Flatiron switchyard to Pole Hill power plant	13.8	November 1950	5.0
Kremmling tap line to Oak Creek substation	115	June 1951	47.0
Estes power plant to Marys Lake power plant	115	April 1951	3.5
Estes power plant to Granby pumping plant	69	January 1951	28.0
Brush switchyard to Limon substation	115	June 1951	73.0
Missouri River Basin:			
Casper (Wyoming) to Gering (Nebraska)	115	August 1950	174.9
Sidney (Nebraska) to Ogallala (Nebraska)	115	May 1951	69.0
Alliance (Nebraska) to Chadron (Nebraska)	115	January 1951	58.0
Glendive (Montana) pumping plant tap line	69/57	June 1951	1.0
Havre (Montana) to Shelby (Montana)	115	June 1951	100.0
Leeds (North Dakota) to Rolla (North Dakota)	69	April 1951	43.0
Jamestown (North Dakota) to Edgeley (North Dakota)	115	April 1951	40.0
Edgeley (North Dakota) to Forman (North Dakota)	69	April 1951	62.0
Total			1,737.3

Construction was continuing on nearly 3,000 miles of high voltage transmission lines at the end of 1951 fiscal year. A large percentage of these lines will be placed in operation during fiscal year 1952.

Power Contracts

Electric power was delivered to numerous major and minor users of power during the fiscal year by the Bureau. Deliveries were made to 38 municipalities, 3 State government agencies, 83 rural electric cooperatives, 7 Federal agencies, 45 public authorities, 34 commercial and industrial users, and 35 privately owned utilities. A summary by classification of customers for the 12 months ending June 30, 1951, is contained in table 9.

During the year, 89 contracts for delivery of power were executed. These include 4 contracts with irrigation districts, 7 with municipalities, 3 with State authorities, 42 with rural electric cooperatives, 5 with other Federal agencies, 2 with public power districts, 23 with privately owned utilities, and 3 with other customers. A number of these contracts were renewals of expiring contracts or revisions resulting from changed contractual conditions.

Contracts for wheeling service were entered into with Idaho Power Co., Pacific Gas & Electric Co., Northwestern Public Service Co., Public Service Co. of Colorado, Montana Power Co., and East River Electric Power Cooperative.

Table 9.—*Summary by classification of customers for 12 months ending June 30, 1951* [1]

	Number of customers	Sales of electric energy (kilowatt-hours)	Revenues from sales of electric energy
Privately owned utilities	35	4, 612, 120. 967	$16, 542, 689
Municipal utilities	38	2, 329, 148. 082	4, 946, 241
State Government utilities	3	653, 014, 128	1, 944, 906
Cooperative utilities (Rural Electric Administration projects)	83	217, 264, 348	1, 457, 282
Other Federal utilities	7	12, 731, 135, 751	8, 337, 066
Residential and domestic	370	3, 841, 338	24, 270
Rural (other than Rural Electric Administration projects)	7	98, 810	1, 049
Commercial and industrial	34	74, 497, 212	454, 168
Public authorities	45	492, 612, 253	1, 195, 997
Interdepartmental	44	151, 625, 312	222, 342
Total all customers	666	21, 265, 358, 201	35, 126, 010

[1] Does not include energy sales and revenues in transactions between Bureau projects.

At the beginning of fiscal year 1952, the Bureau had 282 contracts for delivery of power under negotiation. These include 7 with irrigation districts, 6 with public power districts, 24 with Federal agencies and bureaus, 9 with State authorities, 16 with private utilities, 80 with municipalities, 124 with REA cooperatives, and 16 with other customers. A number of these are for the renewal of existing contracts or for revision to reflect changed conditions. A large number of the contracts under negotiation are for future power deliveries at such time as additional generating capacity now under construction is placed into commercial operation.

GENERAL INVESTIGATIONS

The General Investigations program of the Bureau provides for the planning of the basin and project developments of the Bureau of Reclamation for the utilization of the water resources of the West and Alaska. World War II brought about outstanding increases in population which have aggravated deficiencies in water and power in those areas. The investigation of water and power resources will clear the way for essential future developments necessary for a stable economy and vital contributions to National defense. Despite the advances made in the last decade, economic developments have failed to match the population increases. These investigations are the first steps in matching feasible project construction with existing water and power demands.

The development of the resources of the West for irrigation is short of the half-way mark. Hardly more than a good start has been made on hydroelectric power development. Varying degrees of progress have been made in the accomplishment of objectives such as flood control, sediment control, recreation, fish and wildlife preservation and propagation, and pollution abatement. During the first few decades of water development in the West, the inexpensive and easily developed projects were almost completely exhausted, largely by privately financed development. The remaining potentials are, in the main, long-range basin-wide developments of exceeding complexity which only the Federal Government has the ability to finance.

Sound reclamation development is impossible without adequate planning which in turn is impossible without adequate appropriations for General Investigations with which the investigations are financed. However, the funds available for investigations have not been adequate to meet the needs and the Bureau has been forced to limit the number of investigations included in the program because of this lack of funds.

Comprehensive River Basin Surveys

The Flood Control Act of 1950 authorized the Secretary of the Army to develop comprehensive, integrated plans of development for the Arkansas, White, and Red River Basins in the Southwest. In approving this authorization the President directed all interested Federal agencies to work together in preparing these plans.

An interagency field committee for the Arkansas-White and Red River Basins was established by the Federal Interagency River Basin Committee on June 12, 1950, to coordinate at the field level, work in the comprehensive survey of these basins. The Bureau's cooperative investigations in these basins got under way in fiscal year 1951.

A reconnaissance report on the potential development of water resources in the Territory of Alaska was cleared with the office of the President and submitted to the Congress in July 1951.

The Bureau of Reclamation completed its reconnaissance of the United Western Investigations and closed the office conducting the survey for the present. A report was completed which is undergoing review in the office of the Secretary.

The Bureau's investigations of the Rogue River Basin in Oregon leading to a comprehensive basin report have been substantially completed.

The Bureau has underway a number of other basin surveys of western streams. The investigations of the Washita River Basin in Oklahoma are nearing completion.

New Projects Authorized

In fiscal year 1951 the following projects were authorized for construction by the Congress:

Canadian River project, Texas.
Eklutna project, Alaska.
Minidoka project, Idaho, American Falls Power Division and North Side Pumping Division.
Vermejo project, New Mexico.
Palisades project, Idaho—reauthorized.

The Sacramento River Canals were authorized as a part of the Central Valley project, California, subject to a subsequent finding of feasibility to be made by the Secretary of the Interior. Also, the Alcova Power Plant of the Kendrick project, Wyoming, was authorized by a finding of feasibility under Reclamation law by the Secretary.

Except for the Eklutna project, which would provide power for power-deficient Alaska, and the Alcova Power Plant, which consists only of the construction of a new power plant at an existing dam, none of these newly authorized projects are included in the President's construction programs for fiscal years 1951 or 1952 because of the need to concentrate on national defense, although these projects are urgently needed to help meet existing water and power shortages and to maintain the essential civilian economy.

Other Project Planning Reports

The report on the Collbran project was transmitted to the Congress on July 3, 1951. Reports on the Hells Canyon Division and the Scriver Creek power facilities, Mountain Home Division, Snake River project, Idaho, Oregon, were submitted to the President through the Bureau of the Budget in fiscal year 1951.

In connection with the development of the Colorado River storage project, which would provide storage for the comprehensive development of the Upper Colorado River Basin, a public hearing was held on April 3, 1950, to consider the merits of constructing Echo Park and Split Mountain Dams which would impound water within the Dinosaur National Monument. The hearing attracted large numbers of proponents from Colorado River Basin States and numerous opponents representing recreational interests. After careful analysis of the testimony presented at the hearing, the Secretary approved the completion of a report recommending construction of the dams. The report on the general project plan and on the initial units was completed in fiscal year 1951 and is under review by the affected States and Federal agencies. The plan of development for the Colorado

River storage project provides for aid in the financing of the construction of irrigation projects in the Upper Basin with revenues from the power developments in the storage project. The following initial units and participating projects are recommended for construction in the report:

Initial development, Colorado River storage project

Echo Park unit, Colorado, Utah.
Flaming Gorge unit, Wyoming, Utah.
Glen Canyon unit, Arizona, Utah.
Navajo unit, New Mexico, Colorado.

Participating projects

Central Utah project, Utah (initial phase).
Emery County project, Utah.
Florida project, Colorado.
Hammond project, New Mexico.
LaBarge project, Wyoming.
Lyman project, Wyoming.
Pine River project extension, Colorado, New Mexico.
Seedskadee project, Wyoming.
Silt project, Wyoming.
Smith Fork project, Colorado.

The Paonia project, Colorado, now under construction, is proposed for reauthorization as a participating project. The Eden project, Wyoming, also under construction, has been authorized as a participating project. In addition, the Shiprock Indian project is proposed for authorization in accordance with laws applicable to the development of irrigation projects on Indian reservations.

The report on the initial development of the Gunnison-Arkansas project, Colorado, is under review by the affected States. This project would provide supplemental water and power for the Arkansas Valley by diversion from the Upper Colorado River Basin.

The report on the Joseph City unit, Holbrook project, Arizona, was reviewed by the affected States and Federal agencies in fiscal year 1951.

Definite Plan Reports

Project planning feasibility reports are prepared to present a comprehensive plan for orderly development and conservation of water and related resources, and to ascertain the probable engineering and financial feasibility to a degree sufficient to enable recommendation for or against further work on the plan of a project. These reports are made to secure authorization of the project. Considerable detailed studies and exploratory work usually remains to be done following this stage before sufficient data are available to start the preparation of final designs and specifications. Sometimes projects are authorized by the Congress before the investigations have been completed and the report written even though adequate data may be available to support a favorable recommendation for authorization of a project. Usually there is a fairly long period between authorization of a project and start of actual construction due to lack of funds as well as to lack of detailed information. Therefore, following the authorization of a project, there is need for a report on the additional studies, including investigations and negotiations consummated prior to construction, that are required to determine the definite plan of development for the project. Such a report, known as the Definite Plan Report, is prepared for the whole project, or for a unit of the project, depending on the size and complexity of the plans for development of the project.

Definite plan reports were prepared, reviewed and approved for the following projects or units in fiscal year 1951:

Missouri River Basin project:
    Angostura unit, South Dakota.
    Yellowtail unit, Montana, Wyoming.
Eklutna project, Alaska.

Drafts of a number of other reports were under review at the end of the fiscal year.

River Compacts

The Bureau of Reclamation continued to assist the States in every way practical in the negotiations of interstate water compacts and in compact operation. Bureau representatives have participated directly in the negotiations for most of these compacts. Bureau technical personnel have assisted in the studies necessary for a successful compact.

The Canadian River Compact between New Mexico, Oklahoma, and Texas and the Yellowstone River Compact between Wyoming, Montana, and North Dakota both have been ratified by the appropriate State legislatures and, at the end of the year, were awaiting congressional action.

Negotiations for the Cheyenne River Compact, between Wyoming and South Dakota, were completed but the Wyoming legislature declined to ratify the compact although an earlier, but similar, version had been ratified.

Active negotiations for the Bear River Compact between Wyoming, Utah, and Idaho, were continued during the year.

Hydrology

In addition to its usual hydrologic studies, the Bureau of Reclamation has continued to improve the bases for its technical work, thus continuing to improve the quality of planning for the best utilization of water for irrigation and power and to coordinate flood control operations with the Corps of Engineers.

During the year, such diverse studies as the use of water on Bureau projects, the derivation of flood hydrographs from precipitation, forecasting of seasonal runoff, and sediment movement in rivers and canals were initiated or continued.

In cooperation with the Forest Service, studies of snow melt in the Colorado River basin were continued while studies of evaporation at Lake Hefner, near Oklahoma City, Okla., in cooperation with the Geological Survey, Weather Bureau, and the Department of the Navy were nearing completion.

Field work in sedimentation studies continued. Resurveys of Pathfinder and Seminoe Reservoirs on the North Platte River in Wyoming were completed and special studies of sediment movement in the Niobrara River in Nebraska were undertaken in cooperation with the Geological Survey as were general studies of fluvial morphology.

Particular emphasis was placed on development of better methods of forecasting stream discharge, both seasonal and flood flows. Refinements in method of determining possible flood discharge have resulted in increased confidence that procedures provide a method for adequate and economic spillway design. Better methods of forecasting seasonal runoff are leading to economy of operation in irrigation projects both to the Bureau and to the farmer.

International Streams Investigations

The Bureau participated in the international engineering studies of the Kootenai River in the Columbia River Basin, and in developing information for use in the preparation of reports to the International Joint Commission on all international aspects of the Columbia River.

Engineering work has been advanced on the Waterton-Belly Rivers reference and the Souris-Red Rivers reference made to the International Joint Commission in January 1948. The Commission held public hearings at Ottawa in October 1950, relative to apportionment of flows of the Waterton and Belly Rivers to the United States and Canada. Work was continued on collection of data that will be needed for preparation of plans of mutual advantage to the two countries as soon as the Commission has made its recommendation for apportionment.

Studies of present and future water uses were continued on the Souris and Red Rivers. It was found that from the standpoint of the engineering studies which have been completed, based upon prevailing water flow conditions, no apportionment of the waters of the Red River at the International Boundary appears to be required at the present time.

Artificial Precipitation and Salt Water Conversion

Studies of current technical developments in artificial precipitation and salt water conversion which were initiated in 1947, were accelerated. This was done in anticipation of enactment of legislation (H. R. 6 and 7 and S. 5) which would establish an active research and demonstration program in these fields for the purpose of augmenting the Nation's fresh-water supply. The studies in artificial precipitation made by the Bureau of Reclamation since 1947 were referred to the other agencies of the Department, resulting in the establishment of a departmental committee on artificial precipitation.

PROGRAMS AND FINANCE

New Accounting System

During the fiscal year 1951 the Bureau brought to substantial completion the conversion of its accounting system to modern and utility recognized practices. Under date of July 25, 1950, the system was submitted to the Comptroller General of the United States for approval of the principles and basic concepts underlying the new accounting. Subject to certain qualifications pertaining to development of policies, improvements, and accounting techniques for depreciation, repayment by water users, costing of accrued annual leave and the classification of physical properties for reporting and ratemaking purposes, the Comptroller General, under date of October 6, 1950, formally approved the new accounting system.

Continuous attention has been directed toward the solution of the problems mentioned above, with special consideration directed toward the subject of depreciation accounting. The basic principle of depreciation accounting has been approved by the Commissioner of the Bureau and a committee has been appointed to resolve this complex subject. It is anticipated that depreciation accounting covering all income-producing properties operated by the Government will be adopted by July 1, 1952.

At the time the new accounting system was established it was necessary to require detailed and complete financial statements and reports on a monthly basis in order that the Commissioner's Washington Office could determine from the reports (1) progress being made in analysis of old account balances, (2) accuracy of the new accounting operations and practices, and (3) adequacy and management needs for financial data. As a result of continuing self-analysis, the frequency and simplification of reporting has been revised with a marked reduction in the workload covering this phase of operations.

When conversion was made to the new accounting system it was necessary to convert many of the old account balances without analysis. Since conversion, the importance of early completion of the old account analysis has been emphasized in all offices concerned. Satisfactory progress has been made in this respect and it is anticipated that the analysis will be completed early in the fiscal year 1952.

The completion of the account analysis, the application of accounting improvements and procedures will permit for the first time the preparation of an informative consolidated Bureau balance sheet and financial report as of June 30, 1952.

The Budget and Accounting Procedures Act of 1950, approved September 12, 1950 (Public Law 784, 81st Cong.), granted broad authority to the Comptroller General of the United States and to the Secretary of the Treasury to prescribe such changes in Governmental accounting procedures as would result in simplification, improvement, modernization, and economy.

Pursuant to the provisions of this act several Treasury Department-General Accounting Office joint regulations were issued, which prescribed basic and far-reaching changes and modifications in the accounting procedures of the Government. Many of these revisions were founded on pilot installations tested and checked in Reclamation offices. In order that the joint regulations could be made effective on a uniform and consistent basis throughout the Government, the General Accounting Office prepared a number of accounting-systems memoranda which prescribed certain new and detailed accounting procedures for use by all Government agencies. These actions necessitated a number of changes in the accounting system of the Bureau of Reclamation.

Manualization of Procedures

Numerous revisions in Government accounting procedures were prescribed by the Treasury Department and the General Accounting Office. These actions required almost complete revision of the finance manual. The revisions incorporated not only the changes necessary for conformance to the newly prescribed procedures but also included refinements and improvements resulting from experience gained in actual practice in the finance offices, and from finance conferences and joint studies conducted by members of the Washington and field staffs. The general ledger charts of accounts were consolidated and simplified without sacrifice of information. Additional economies and simplification were obtained in revisions pertaining to allotment and fund accounting, cost accounting, power operation, and irrigation accounting, etc.

Full cognizance is had of the need for additional standardization and uniformity in payroll operations. During the last quarter of fiscal year 1951, pilot installations were made of payroll procedures on bookkeeping machines in two regions. Additional pilot installations will be made in selected offices of the remaining regions early in the fiscal year 1952 after which standard payroll procedures will be manualized.

Because of the improvements and economies obtained in the application of machine accounting in certain field offices during the fiscal year 1951, it is proposed to conduct surveys in additional offices during the ensuing year to ascertain whether similar results can be effected on a broader scale. In addition, it is proposed to review machine accounting operations presently in effect to determine whether broader application to additional accounting would be advantageous. At the conclusion of these studies, it is proposed to manualize machine-accounting procedures so that the most desirable and consistent benefits will be obtained uniformly throughout all Bureau offices involved.

Program Coordination

Formalizing of program procedures to assure coordination of program schedules with budget documents and program reports and to provide effective administrative control of field activities had been accomplished to a large degree when the fiscal year began. During the year, emphasis was placed on activities directed toward refinement and simplification of existing procedures.

Particular effort was made to relate programs and budgets to the accounts. More orderly and systematic procedures were established for handling the annual review of program documents prior to their official approval by the Commissioner. Conferences were held in Washington and in the field to develop more effective and workable program procedures. Closer liaison was maintained between the Washington Office and field offices to afford a better understanding of the Commissioner's policies and requirements and to insure the availability of coordinated and up-to-date program documents for keeping top management, the Congress, and the Bureau of the Budget informed of Reclamation's programs.

The international situation was beginning to have its effect on the Bureau's activities during the latter part of the fiscal year. Changed criteria required reexamination of the Bureau's program and in some cases necessitated rescheduling of programmed work. Loss of personnel to the defense agencies also necessitated simplification of programing procedures.

Efforts will continue to be directed toward the achievement of more realistic programing, while scheduling procedures will be subject to continuous scrutiny for improvement and simplification.

Table 10.—*Schedule of public works construction programs*

Agency priority	Name and location of project	Estimated total	Funds available		Funds required		Obligations to June 30, 1951
			Actual to June 30, 1951	Estimated fiscal year 1952	Estimated additional fiscal year 1953	Additional to complete (col. 3)—(cols. 4, 5, and 6)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	1. AUTHORIZED PROJECTS						
	A. 54 completed projects and divisions	$279, 864, 621	$279, 864, 621	-----	-----	-----	$279, 864, 621
	B. Continuing divisions or projects:						
	All-American Canal, Ariz.-Calif	67, 539, 600	60, 794, 161	$3, 154, 000	$1, 197, 000	$2. 394, 439	60, 479, 278
	Austin, W. C., Oklahoma	12, 413, 748	11, 908, 904	135, 000	30, 000	339, 844	11, 865, 164
	Boise-Anderson ranch, Idaho	30, 720, 323	30 720, 323	-----	-----	-----	30, 154, 265
	Boise drainage, Idaho	85, 630	85, 630	-----	-----	-----	36, 388
	Boise-Payette, Idaho	17, 273, 050	17, 118, 850	154, 200	-----	-----	16, 740, 469
	Boulder Canyon, Ariz.-Nev	165, 509, 000	155, 955, 099	2, 900, 000	95, 000	6, 558, 901	155, 854, 684
	Buffalo Rapids, first division, Montana	2, 579, 783	1, 982. 783	200. 000	222, 000	175, 000	1. 830, 479
	Buffalo Rapids, second division, Montana	2, 075, 012	1, 571, 412	77, 600	111, 000	315, 000	1, 554, 427
	Cachuma, Calif	34, 193, 400	13. 370, 900	10, 000, 000	8, 500, 000	2, 322, 500	13, 039, 445
	Central Valley, Calif	661, 354, 859	360, 371. 749	33, 870, 000	51, 398, 000	215, 715, 110	359, 305, 177
	Colorado-Big Thompson, Colo	160, 331, 442	116, 145, 788	19, 000, 000	19, 100, 000	6, 085. 654	113, 609, 306
	Colorado River front work and levee system, Arizona-California-Nevada	6, 057, 000	450, 000	[1] 2, 400, 000	[2] 3, 207, 000	-----	433, 454
	Columbia Basin, Wash	702, 500, 000	416, 179, 923	27, 000, 000	24, 600, 000	234, 720, 077	415, 955, 466
	Davis Dam, Ariz.-Nev	117, 352, 960	104, 029, 792	6, 572, 000	1, 888, 000	4, 863, 168	101, 904, 043
	Deschutes—north unit, Oregon	11, 140, 000	10. 386, 915	300, 000	-----	453, 085	9, 994, 495
	Eden, Wyo	5, 989, 500	2, 054, 376	1. 900, 000	760. 000	1, 275, 124	2, 011, 400
	Eklutna, Alaska	33, 751. 695	1, 100, 000	5, 761, 400	13, 000, 000	13, 890. 295	1, 099, 129
	Fort Peck, Mont	23, 243, 738	8, 497. 738	1, 500, 000	-----	13, 246, 000	8, 226, 639
	Fort Sumner, N. Mex	2, 495, 000	2. 431, 000	64, 000	-----	-----	2, 422, 048
	Gila, Ariz	53, 162. 824	27, 524, 513	6, 870, 000	5, 682, 000	13, 086, 311	27, 318, 361
	Hungry Horse, Mont	109, 230, 000	67, 696, 190	22, 000, 000	13, 245, 000	6, 288, 810	67, 445, 362
	Kendrick, Wyo	31, 219, 479	23, 604, 591	2, 250, 000	4, 100, 000	1, 264, 888	23, 027, 533
	Kern River, Calif	135, 000	42, 500	75, 000	15, 000	2, 500	23, 915
	Kings River, Calif	261, 097	225, 102	12, 000	-----	23, 995	173, 546
	Klamath, Oreg.-Calif	18, 613, 475	13, 936, 058	400, 000	900, 000	3. 377, 417	13, 760, 111
	Lewiston orchards, Idaho	2, 450, 272	2, 450, 272	-----	-----	-----	2, 413, 503
	Milk River, Fresno Dam, Mont	2, 000, 000	1, 851, 226	-----	-----	148, 774	1, 825, 641
	Minidoka, Gooding, Idaho	6, 676, 186	6, 676, 186	-----	-----	-----	6, 632, 533

Missouri River Basin, various	3, 431, 652, 796	266, 299, 627	[3] 53, 109, 075	113, 090, 000	2, 999, 154, 094	248, 465, 279
Ochoco, Oreg	821, 960	1, 152, 056			—330, 096	800, 591
Palisades, Idaho-Wyo	76, 601, 000	3, 327, 473	[4] 10, 000, 000	12, 000, 000	51, 273, 527	3, 122, 052
Paonia, Colo	1, 886, 702	1, 909, 178	186, 000		—208, 476	1, 848, 713
Provo River, Utah	33, 813, 951	26, 972, 751	2, 766, 000	3, 883, 000	192, 200	26, 934, 679
Rehabilitation and betterment, various	28, 591, 327	7, 182, 226	2, 852, 450	2, 342, 000	16, 214, 651	6, 466, 110
Rio Grande, Elephant Butte power, New Mexico-Texas	15, 214, 919	13, 776, 919	1, 288, 000	150, 000		13, 773, 137
Riverton, Wyo	24, 680, 480	18, 516, 480	900, 000	2, 052, 000	3, 212, 000	17, 646, 499
San Luis Valley, Colo	45, 015, 346	4, 729, 614	600, 000	58, 000	39, 627, 732	4, 589, 869
Shoshone, Wyo	16, 777, 349	14, 211, 349	200, 000	216, 000	2, 150, 000	13, 870, 507
Sun River, Greenfields, Mont	9, 671, 262	9, 517, 147	40, 400	40, 000	73, 715	9, 516, 563
Tucumcari, N. Mex	16, 763, 374	15, 554, 963	200, 000	204, 000	804, 411	15, 534, 659
Valley Gravity, Tex	126, 552, 000	2, 251, 294			124, 300, 706	1, 435, 551
Vermejo, N. Mex	2, 679, 000	118, 000	[5] 295, 000	1, 034, 000	1, 232, 000	118, 000
Water conservation and utilization, various	4, 495, 492	4, 495, 492				4, 477, 481
Yakima-Roza, Wash	23, 449, 412	21, 027, 866	48, 600	886, 000	1, 486, 946	20, 965, 044
Subtotals continuing divisions or projects	6, 139, 020, 443	1, 870, 204, 416	219, 080, 725	284, 005, 000	3, 765, 730, 302	1, 838, 700, 986
C. New divisions or projects:						
Canadian River, Tex	84, 656, 000	72, 600	100, 000	1, 200, 000	83, 283, 400	72, 600
Carlsbad, Alamogordo, N. Mex	1, 731, 000	75, 000		416, 000	1, 240, 000	75, 000
Middle Rio Grande, N. Mex	29, 606, 000	638, 400	1, 513, 000	10, 954, 000	16, 500, 600	638, 400
Minidoka, American Falls Power, Idaho	8, 097, 000	382, 455	40, 000	1, 300, 000	6, 374, 545	382, 455
Minidoka, north side pumping, Idaho	11, 901, 233	985, 689		603, 000	10, 312, 544	779, 989
Solano, Calif	38, 745, 000	355, 200	45, 000	4, 958, 000	33, 386, 800	355, 200
Weber Basin, Utah	72, 313, 000	1, 093, 942	280, 000	3, 250, 000	67, 689, 058	1, 063, 546
Yakima-Kennewick, Wash	13, 206, 568	865, 044	54, 000	2, 560, 000	9, 727, 524	865, 044
Subtotal new divisions or projects	260, 255, 801	4, 468, 330	2, 032, 000	25, 241, 000	228, 514, 471	4, 232, 234
Total authorized divisions and projects	6, 679, 140, 865	2, 154, 537, 367	221, 112, 725	309, 246, 000	3, 994, 244, 773	2, 122, 797, 841

See footnotes at end of table.

Table 10.—*Schedule of public works construction programs*—Continued

Agency priority	Name and location of project	Estimated obligations							
		1952	1953	1954	1955	1956	1957	1958	Balance to complete or projects not scheduled
(1)	(2)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
	1. AUTHORIZED PROJECTS								
	A. 54 completed projects and divisions								
	B. Continuing divisions or projects:								
	All-American Canal, Ariz.-Calif	$2,603,041	$1,943,467	$2,343,400	$102,000	$15,000	$15,000	$15,000	$23,414
	Austin, W. C., Oklahoma	178,740	30,000	139,000	139,000	61,844			
	Boise-Anderson ranch, Idaho	514,458	51,600						
	Boise drainage, Idaho	5,000	5,000						39,242
	Boise-Payette, Idaho	332,581	200,000						
	Boulder Canyon, Ariz.-Nev	2,325,415	770,000	530,983	1,927,304	3,789,059	311,555		
	Buffalo Rapids, first division, Montana	352,304	222,000	175,000					
	Buffalo Rapids, second division, Montana	94,585	111,000	150,000	110,000	55,000			
	Cachuma, Calif	10,331,455	8,500,000	2,322,500					
	Central Valley, Calif	34,936,572	51,398,000	85,665,756	44,973,401	15,338,356	14,970,265	12,316,247	42,451,085
	Colorado-Big Thompson, Colo	21,536,482	19,100,000	2,913,000					3,172,654
	Colorado River front work and levee system, Arizona-California-Nevada	2,416,546	3,207,000						
	Columbia Basin, Wash	27,224,457	24,600,000	12,000,000	8,200,000	6,000,000	8,500,000	6,900,000	193,120,077
	Davis Dam, Ariz.-Nev	7,169,088	3,416,661	2,612,246	2,250,922				
	Deschutes—north unit, Oregon	340,156	74,349	25,000	20,000	20,000			666,000
	Eden, Wyo	1,942,976	760,000	590,924	462,500	221,700			
	Eklutna, Alaska	5,762,280	13,000,000	11,810,000	2,080,295				
	Fort Peck, Mont	1,450,099	321,000	420,000	300,000	600,000	1,000,000	1,000,000	9,926,000
	Fort Sumner, N. Mex	72,952							
	Gila, Ariz	7,076,152	5,682,000	4,055,764	2,936,908	2,064,254	2,333,599	456,880	1,238,906
	Hungry Horse, Mont	22,250,828	13,245,000	6,288,810					
	Kendrick, Wyo	2,827,058	4,100,000	990,000	221,255	53,633			
	Kern River, Calif	67,500	41,085	2,500					
	Kings River, Calif	28,000	34,000	25,551					
	Klamath, Oreg.-Calif	575,947	900,000	197,000	5,000	3,000			3,172,417
	Lewiston orchards, Idaho	36,769							
	Milk River, Fresno Dam, Mont	25,585							148,774
	Minidoka, Gooding, Idaho	20,000		23,653					

Missouri River Basin, various	[3] 67, 080, 930	115, 599, 685	163, 403, 034	179, 442, 776	181, 348, 444	171, 525, 409	179, 118, 938	2, 125, 668, 301
Ochoco, Oreg	21, 369							
Palisades, Idaho-Wyo	[4] 10, 205, 421	12, 000, 000	12, 777, 302	14, 189, 268	14, 795, 000	7, 757, 984	1, 753, 973	
Paonia, Colo	37, 989							
Provo River, Utah	2, 804, 072	3, 883, 000	192, 200					
Rehabilitation and betterment, various	3, 545, 275	2, 365, 291	2, 353, 000	2, 805, 001	1, 610, 000	1, 610, 000	1, 610, 000	6, 226, 650
Rio Grande, Elephant Butte power, New Mexico-Texas	1, 291, 782	150, 000						
Riverton, Wyo	1, 769, 981	2, 052, 000	1, 637, 000	1, 151, 000	424, 000			
San Luis Valley, Colo	427, 524	370, 221	296, 593	4, 430, 311	10, 680, 000	10, 488, 279	10, 202, 000	3, 530, 549
Shoshone, Wyo	469, 191	287, 651	111, 000	171, 000	131, 000			1, 737, 000
Sun River, Greenfields, Mont	40, 984	40, 000	51, 100	22, 615				
Tucumcari, N. Mex	220, 304	204, 000	343, 923	460, 488				
Valley Gravity, Tex								125, 116, 449
Vermejo, N. Mex	[5] 295, 000	1, 034, 000	814, 000	315, 000				103, 000
Water conservation and utilization, various	18, 011							
Yakima-Roza, Wash	111, 422	886, 000	1, 401, 697	85 249				
Subtotals continuing divisions or projects	240, 836. 281	290, 584, 010	316, 661, 936	266, 801, 293	237, 210, 290	218, 512, 091	213, 373. 038	2, 516, 340, 518
C. New divisions or projects:								
Canadian River, Tex	100, 000	1, 200, 000	7, 664, 000	25, 977, 500	28, 016, 600	15, 701, 700	5, 123, 600	800, 000
Carlsbad, Alamogordo, N. Mex		416, 000	1, 240, 000					
Middle Rio Grande, N. Mex	1, 513, 000	10, 954, 000	2, 570, 300	2, 464, 000	3, 965, 000	2, 171, 000	29, 400	5, 300, 900
Minidoka, American Falls Power, Idaho	40, 000	1, 300, 000	3, 670, 000	2, 704, 545				
Minidoka, north side pumping, Idaho	100, 000	708, 700	1, 968, 561	2, 197, 440	2, 086, 550	1, 501, 665	1, 498, 405	1, 059, 923
Solano, Calif	45, 000	4, 958, 000	13, 186, 600	12, 661. 200	4, 977, 000	931, 000		1, 631, 000
Weber Basin, Utah	310, 396	3, 250, 000	13, 936, 000	13, 745, 000	8, 278, 000	7, 311, 000	6, 467, 000	17, 952, 058
Yakima-Kennewick, Wash	54, 000	2, 560, 000	6, 599, 530	2, 259, 253	818, 450	30, 000	20, 309	
Subtotal new divisions or projects	2, 162, 396	25, 346, 700	50, 834, 991	62, 008, 920	48, 141, 600	27, 646, 365	13, 138, 714	26, 743, 881
Total authorized divisions and projects	242, 998, 677	315, 930, 710	367, 496, 924	328, 810, 213	285, 351, 890	246, 158, 456	226, 511, 752	2, 543, 084, 399

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[1] Includes contribution of $1,000,000.
[2] Includes contribution of $1,200,000.
[3] Includes supplemental funds of $5,000,000.
[4] Includes supplemental funds of $10,000,000.
[5] Includes supplemental funds of $285,000.

Table 10.—*Schedule of public works construction programs*—Continued

Agency Priority	Name and location of project	Estimated total	Funds available		Funds required		Obligations to June 30, 1951
			Actual to June 30, 1951	Estimated fiscal year 1952	Estimated additional fiscal year 1953	Additional to complete (col. 3)-(cols. 4, 5, and 6)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	MISSOURI RIVER BASIN						
	Phase A—Units ready for or under construction:						
	Bighorn Basin division, Owl Creek unit, Wyoming	$3,388,399	$1,473,399		$455,000	$1,460,000	$676,660
	Blue Division, Belvidere unit, Nebraska	13,990,000			1,000,000	12,990,000	
	Bostwick division, Nebraska-Kansas	48,039,308	9,740,632	$1,900,000	5,030,000	31,368,676	8,082,475
	Boysen division, Boysen unit, Wyoming	34,320,515	31,810,515	1,900,000	610,000		31,206,885
	Cannonball division, Cannonball unit, North Dakota	12,621,772	819,772			11,802,000	596,995
	Cheyenne division:						
	Angostura unit, South Dakota	13,512,779	10,597,779	1,200,000	1,175,000	540,000	10,551,238
	Keyhole unit, Wyoming	4,355,163	3,279,266	1,282,700		−206,803	3,273,519
	Rapid Valley unit, South Dakota	9,074,827	330,827	200,000	2,135,000	6,409,000	210,270
	Frenchman-Cambridge division, Nebraska	66,685,340	36,249,069	7,800,000	3,580,000	19,056,271	35,282,472
	Grand Division, Shadehill unit, South Dakota	10,693,971	7,379,971	100,000	368,000	2,846,000	7,299,041
	Heart division:						
	Dickinson unit, North Dakota	1,630,805	1,343,805	6,000	91,000	190,000	1,310,952
	Heart Butte unit, North Dakota	5,709,834	3,993,834	500,000	420,000	796,000	3,868,423
	Helena-Great Falls division, Canyon Ferry unit, Montana	29,430,011	15,338,011	8,000,000	4,833,000	1,259,000	14,432,210
	Lower Bighorn division, Yellowtail unit, Montana	99,586,015	2,274,015		6,812,000	90,500,000	1,893,253
	Marias division, Lower Marias unit, Montana	60,250,000	2,843,083		4,200,000	53,206,917	2,336,972
	Middle Loup division, Sargent unit, Nebraska	11,163,000	807,240	131,400	1,136,000	9,088,360	681,114
	Missouri-Souris division, Jamestown unit, North Dakota	10,768,746	396,746		1,000,000	9,372,000	245,770
	Missouri diversion unit, Montana	102,212,885	2,084,885		4,530,000	95,598,000	1,301,427
	Moreau division, Bixby unit, South Dakota	13,063,997	1,414,231			11,649,766	1,322,997
	North Dakota pumping division, Fort Clark unit, North Dakota	602,741	426,741	100,000	57,000	19,000	101,397
	Oregon Trail division:						
	Glendo unit, Wyoming	42,049,157	779,534	275,000	600,000	40,394,623	497,532
	Kortes unit, Wyoming	14,593,961	14,593,961				14,497,644
	Smoky Hill division:						
	Cedar Bluff unit, Kansas	18,675,750	15,641,073		904,000	2,130,677	14,116,157
	Wilson unit, Kansas	17,646,000		[1] 400,000	4,000,000	13,246,000	
	Solomon division:						
	Glen Elder unit, Kansas	29,190,000		[1] 400,000	6,200,000	22,590,000	
	Kirwin unit, Kansas	18,187,000	371,483	[2] 3,325,000	7,200,000	7,290,517	371,172
	Webster unit, Kansas	14,135,000		[1] 600,000	6,475,000	7,060,000	

South Platte division, Narrows unit, Colorado	39, 310, 000	1, 245, 930			38, 064, 070	996, 762
Three Forks division, Crow Creek Pump unit, Montana	1, 541, 523	161, 523	100, 000	500, 000	780, 000	121, 377
Transmission division, various	307, 571, 351	32, 974, 275	13, 930, 679	33, 571, 000	227, 095, 397	30, 426, 330
Upper Republican division, St. Francis unit, Colorado-Kansas	15, 266, 050	14, 673, 020			593, 030	13, 116, 052
Yellowstone division:						
Cartwright unit	282, 159	216, 359	33, 800		32, 000	115, 587
Sadie Flat unit, Montana	2, 189, 057	190, 371	5, 000		1, 993, 686	179, 210
Savage unit, Montana	504, 404	476, 404		2, 000	26, 000	471, 541
Sidney unit, Montana	710, 728	151, 728	50, 000		509, 000	147, 430
Subtotal—Phase A	1, 072, 952, 248	214, 079, 482	42, 239, 579	96, 884, 000	719, 749, 187	199, 730, 774
Phase B—Units being prepared for construction	692, 847, 548	11, 036, 438	2, 557, 600	3, 625, 000	675, 628, 510	9, 677, 799
Phase C—Continuing work on the general plan of development	1, 365, 853, 000	15, 815, 885	[3] 3, 233, 896	3, 904. 000	1, 342, 899, 219	14, 520, 705
Phase D—Work in connection or in cooperation with Corps of Engineers		216, 684	78, 000	82, 000	−376, 684	182, 284
Phase E—Operation and maintenance				1, 095, 000	−1, 095, 000	
Total—M. R. B. (Bureau of Reclamation)	3, 131, 652, 796	241, 148, 489	48, 109, 075	105, 590, 000	2, 736, 805, 232	224, 111, 562
Participating agencies	300, 000, 000	25, 151, 138	5, 000, 000	7, 500, 000	262, 348, 862	24, 353, 717
Grand total—M. R. B	3, 431, 652, 796	266, 299, 627	53. 109, 075	113, 096, 000	2, 999, 154, 094	248, 465, 279

See footnotes at end of table.

Table 10.—*Schedule of public works construction programs*—Continued

Agency priority	Name and location of project	Estimated obligations							
		1952	1953	1954	1955	1956	1957	1958	Balance to complete or projects not scheduled
(1)	(2)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
	MISSOURI RIVER BASIN								
	Phase A—Units Ready for or under construction:								
	Bighorn Basin division, Owl Creek unit, Wyoming	$377, 739	$874, 000	$1, 150, 000	$310, 000				
	Blue Division, Belvidere unit, Nebraska		1, 000, 000	4, 050, 000	4, 450, 000	$1, 310, 000	$20, 000	$20, 000	$3, 140, 000
	Bostwick division, Nebraska-Kansas	3, 558, 157	5, 030, 000	5, 839, 000	5, 813, 000	5, 343, 000	4, 800, 000	3, 620, 000	5, 962, 676
	Boysen division, Boysen unit, Wyoming	2, 503, 630	610, 000						
	Cannonball division, Cannonball unit, North Dakota	22, 777	200, 000	1, 660, 000	3, 360, 000	3, 360, 000	2, 410, 000	856, 000	156, 000
	Cheyenne division:								
	Angostura unit, South Dakota	1, 246, 541	1, 175, 000	17, 000	7, 000	4, 000	4, 000	4, 000	504, 000
	Keyhole unit, Wyoming	988, 447	80, 034	13, 163					
	Rapid Valley unit, South Dakota	320, 557	2, 135, 000	3, 795, 000	1, 723, 000	740, 000	102, 000	37, 000	12, 000
	Frenchman-Cambridge division, Nebraska	8, 766, 597	3, 580, 000	2, 623, 110	2, 384, 907	3, 709, 916	4, 931, 680	2, 566, 001	2, 840, 657
	Grand Division, Shadehill unit, South Dakota	146, 930	402, 000	110, 000	9, 000	9, 000	9, 000	7, 000	2, 702, 000
	Heart division:								
	Dickinson unit, North Dakota	38, 853	91, 000	118, 000	72, 000				
	Heart Butte unit, North Dakota	625, 411	420, 000	520, 000	249, 000	27, 000			
	Helena-Great Falls division, Canyon Ferry unit, Montana	8, 905, 801	4, 833, 000	1, 233, 000	26, 000				
	Lower Bighorn division, Yellowtail unit, Montana	380, 762	6, 812, 000	17, 801, 000	27, 400, 000	29, 309, 000	14, 530, 000	969, 000	500, 000
	Marias division, Lower Marias unit, Montana	506, 111	4, 200, 000	7, 145, 000	11, 290, 000	10, 958, 000	6, 786, 000	5, 545, 000	11, 482, 917
	Middle Loup division, Sargent unit, Nebraska	257, 526	1, 136, 000	1, 971, 700	1, 489, 189	12, 000	12, 000	1, 606, 340	3, 997, 131
	Missouri-Souris division, Jamestown unit, North Dakota	150, 976	1, 000, 000	2, 100, 000	2, 010, 000	1, 095, 000			4, 167, 000
	Missouri diversion unit, Montana	313, 458	5, 000, 000	9, 120, 000	6, 570, 000	5, 490, 000	7, 690, 000	16, 520, 000	50, 208, 000
	Moreau division, Bixby unit, South Dakota	6, 000							11, 735, 000
	North Dakota pumping division, Fort Clark unit, North Dakota	425, 344	57, 000						19, 000
	Oregon Trail division:								
	Glendo unit, Wyoming	557, 002	600, 000	6, 000, 000	13, 600, 000	14, 440, 000	6, 354, 623		
	Kortes unit, Wyoming	96, 317							
	Smoky Hill division:								
	Cedar Bluff unit, Kansas	896, 655	1, 622, 261	1, 293, 537	70, 000	77, 140	65, 000	2, 000	623, 000
	Wilson unit, Kansas	1, 400, 000	4, 000, 000	5, 500, 000	3, 410, 000	10, 000	15, 000	15, 000	4, 296, 000

Solomon division:								
Glen Elder unit, Kansas	[1] 400,000	6,200,000	8,500,000	8,000,000	560,000	20,000	20,000	5,490,000
Kirwin unit, Kansas	[2] 3,325,011	7,200,000	3,694,828	1,625,000	1,326,689	243,000	5,000	396,000
Webster unit, Kansas	[1] 600,000	6,475,000	3,070,000	1,635,000	61,000	15,000	15,000	2,264,000
South Platte division, Narrows unit, Colorado	198,253	50,915	2,925,000	6,515,000	6,650,000	6,100,000	5,800,000	10,074,070
Three Forks division, Crow Creek Pump unit, Montana	140,146	500,000	726,000	20,000	10,000	10,000	14,000	----------
Transmission division, various	16,370,624	33,679,000	42,942,113	24,549,018	15,150,644	15,712,300	11,227,000	117,154,322
Upper Republican division, St. Francis unit, Colorado-Kansas	340,360	169,000	204,000	848,000	426,638	1,000	2,000	159,000
Yellowstone division:								
Cartwright unit	105,372	29,200	4,000	3,000	9,000	16,000	----------	----------
Sadie Flat unit, Montana	16,161	----------	----------	----------	----------	----------	----------	1,993,686
Savage unit, Montana	4,953	2,000	26,000	----------	----------	----------	----------	----------
Sidney unit, Montana	37,000	17,298	210,000	220,000	10,000	16,000	53,000	----------
Subtotal—Phase A	52,939,771	99,179,708	134,352,451	127,658,114	100,449,027	69,862,603	48,903,341	239,876,459
Phase B—Units being prepared for construction	3,702,262	3,838,977	12,116,000	33,841,000	48,700,000	45,020,574	45,209,000	490,741,936
Phase C—Continuing work on the general plan of development	[3] 4,529,076	3,904,000	5,565,554	6,222,000	20,191,000	44,490,000	72,511,000	1,193,919,665
Phase D—Work in connection or in cooperation with Corps of Engineers	112,400	82,000	87,000	80,000	80,000	71,000	59,967	−754,651
Phase E—Operation and maintenance	----------	1,095,000	1,282,029	1,641,662	1,928,417	2,081,232	2,435,630	−10,463,970
Total—M. R. B. (Bureau of Reclamation)	61,283,509	108,099,685	153,403,034	169,442,776	171,348,444	161,525,409	169,118,938	1,913,319,439
Participating agencies	5,797,421	7,500,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	212,348,862
Grand total—M. R. B.	67,080,930	115,599,685	163,403,034	179,442,776	181,348,444	171,525,409	179,118,938	2,125,668,301

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[1] Supplemental funds.
[2] Includes $3,200,000 supplemental funds.
[3] Includes $400,000 supplemental funds.

Schedule of irrigation and power development

Line No.	Name and location of project	Schedule of power development—kilowatts (in thousands)									Schedule of irrigation development—acres (in thousands)										Line No.
		Existing 6-30-51	1952	1953	1954	1955	1956	1957	1958	Estimated additional	Type	Existing 6-30-51	1952	1953	1954	1955	1956	1957	1958	Estimated additional	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
	A. 54 completed projects and divisions.	179.4									N	1,827.4									
											S	1,603.9									
	B. Continuing divisions or projects:																				
1	All-American Canal, Ariz.-Calif.	24.4		9.6							N	453.3	6.1	11.7		11.5					1
											S	20.5	.6	2.6							
2	Austin, W. C., Oklahoma										N										2
											S	47.8									
3	Boise-Anderson ranch, Idaho.	13.5	13.5								N										3
											S	300.0									
4	Boise Drainage (Kuna irrigation district) Idaho.										N										4
											S										
5	Boise-Payette, Idaho										N	52.8									5
											S										
6	Boulder Canyon, Arizona-Nevada.	1,034.8	215.0					82.5			N										6
											S										
7	Buffalo Rapids, first division, Montana.										N	15.7									7
											S										
8	Buffalo Rapids, second division, Montana.										N	11.6									8
											S										
9	Cachuma, Calif										N				23.7						9
											S				6.0						
10	Central Valley, Calif	450.0				529.5					N	2.2		8.5	183.6	80.0	60.0	50.0	104.0		10
											S	471.4	45.2	19.1	112.7	90.0	20.4				
11	Colorado-Big Thompson, Colo.	74.7		96.3						6.7	N										11
											S	24.0	206.0	58.0	122.0	205.0					
12	Colorado River front work and levee system, Arizona-California-Nevada.										N										12
											S										
13	Columbia Basin, Wash	1,866.0	108.0								N	6.8	65.9	59.6	53.1	58.7	51.9	43.8	48.7	640.0	13
											S										
14	Davis Dam, Ariz.-Nev	225.0									N										14
											S										
15	Deschutes-north unit, Oregon.	1.5									N	50.0									15
											S	46.0									
16	Eden, Wyo										N				2.0	5.0	4.0				16
											S				3.0	3.0	3.0				
17	Eklutna, Alaska					30.0					N										17
											S										

18	Fort Peck, Mont										N										18
											S										
19	Fort Sumner, N. Mex										N										19
											S	6.5									
20	Gila, Ariz										N	20.1	2.0	10.4	24.1	17.0	5.4	8.8		4.9	20
											S	1.0	9.0	2.7	0.6	2.0				7.0	
21	Hungry Horse, Mont			142.5	142.5						N										21
											S										
22	Kendrick, Wyo	32.4			36.0						N	7.0	2.0	2.0	2.0	2.0	5.0				22
											S										
23	Kern River, Calif										N										23
											S										
24	Kings River, Calif										N										24
											S										
25	Klamath, Oreg.-Calif										N	85.4									25
											S	121.4		3.8						21.2	
26	Lewiston orchards, Idaho										N	3.8									26
											S										
27	Milk River, Fresno Dam, Mont.										N										27
											S										
28	Minidoka, Gooding, Idaho										N	8.0									28
											S	84.0									
29	Missouri River Basin, various.	36.0	16.2		50.0		20.0	230.0		657.6	N	2.3	16.5	23.4	38.1	57.2	62.7	122.3	121.9	4,900.2	29
											S		55.7	0.5	5.3	26.0	1.9	66.0	39.8	926.2	
30	Ochoco, Oreg										N										30
											S										
31	Palisades, Idaho-Wyo							114.0			N										31
											S							650.0			
32	Paonia, Colo										N		.3								32
											S		12.1								
33	Provo River, Utah			7.0							N										33
											S	46.6	6.0	4.0							
34	Rehabilitation and betterment, various										N										34
											S										
35	Rio Grande, Elephant Butte Power, N. Mex.-Tex	24.3									N										35
											S										
36	Riverton, Wyo	1.6									N	62.5	6.0	6.0		12.0	11.5				36
											S										
37	San Luis Valley, Colo										N										37
											S		73.9	12.3						469.8	
38	Shoshone, Wyo	10.6									N	107.5								7.5	38
											S										
39	Sun River, Greenfields, Mont										N	83.0									39
											S										
40	Tucumcari, N. Mex										N	42.3									40
											S										
41	Valley Gravity, Tex										N										41
											S									552.0	
42	Vermejo, N. Mex										N										42
											S					7.2					

Schedule of irrigation and power development—Continued

		Schedule of power development—kilowatts (in thousands)									Schedule of irrigation development—acres (in thousands)										
Line No. (1)	Name and location of project (2)	Existing 6-30-51 (3)	1952 (4)	1953 (5)	1954 (6)	1955 (7)	1956 (8)	1957 (9)	1958 (10)	Estimated additional (11)	Type (12)	Existing 6-30-51 (13)	1952 (14)	1953 (15)	1954 (16)	1955 (17)	1956 (18)	1957 (19)	1958 (20)	Estimated additional (21)	Line No. (22)
	B. Continuing divisions or projects—Continued																				
43	Water conservation and utilization, various										N	11.2									43
											S	9.0									
44	Yakima-Roza, Wash					10.0					N	72.0									44
											S										
	Subtotals, continuing divisions or projects	3,794.8	352.7	255.4	228.5	569.5	20.0	426.5		664.3	N	1,097.5	98.8	121.6	326.6	243.4	200.5	224.9	274.6	5,552.6	
											S	1,178.2	408.5	103.0	249.6	333.2	25.3	716.0	39.8	1,976.2	
	C. New divisions or projects:																				
45	Canadian River, Tex										N								20.0		45
											S										
46	Carlsbad, Alamogordo, N. Mex										N										46
											S										
47	Middle Rio Grande, N. Mex										N										47
											S							84.9			
48	Minidoka, American Falls Power, Idaho					30.0					N										48
											S										
49	Minidoka, north side pumping, Idaho										N	5.1				10.0	10.0	23.7	10.7	10.0	49
											S										
50	Solano, Calif										N					13.0	5.0	4.0	4.0	36.7	50
											S					5.0	5.0	6.1			
51	Weber Basin, Utah						5.4				N							5.0	9.0	37.0	51
											S						2.0	3.0	6.0	16.0	
52	Yakima-Kennewick, Wash					12.0					N					5.0	11.7				52
											S					4.3					
53	Subtotals, new divisions or projects					42.0	5.4				N	5.1				28.0	26.7	32.7	43.7	83.7	53
											S					9.3	7.0	94.0	6.0	16.0	
	Total authorized divisions and projects	3,974.2	352.7	255.4	228.5	611.5	25.4	426.5		664.3	N	2,930.0	98.8	121.6	326.6	271.4	227.2	257.6	318.3	5,636.3	
											S	2,782.1	408.5	103.0	249.6	342.5	32.3	810.0	45.8	1,992.2	

Line No.	Name and location of project	Schedule of power development—kilowatts (in thousands)									Schedule of irrigation development—acres (in thousands)										Line No.
		Existing 6-30-51	1952	1953	1954	1955	1956	1957	1958	Estimated additional	Type	Existing 6-30-51	1952	1953	1954	1955	1956	1957	1958	Estimated additional	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
	MISSOURI RIVER BASIN																				
	Phase A—Units ready for or under construction:																				
1	Big Horn Basin division, Wyo., Owl Creek unit.										N										1
											S				4.4	13.6					
2	Blue division, Nebr., Belvidere unit.										N									15.0	2
											S										
3	Bostwick division, Nebr.-Kans.										N		12.5		9.5	10.8	7.8	26.4	9.7	12.7	3
											S										
4	Boysen division, Wyo., Boysen unit.		15.0								N										4
											S										
5	Cannonball division, N. Dak., Cannonball unit.										N							5.0	4.0	3.5	5
											S										
	Cheyenne division, S. Dak.:																				
6	Angostura unit		1.2								N		4.0	8.2							6
											S										
7	Keyhole unit, Wyo										N										7
											S		55.7								
8	Rapid Valley unit, S. Dak.										N						1.0	1.2			8
											S					12.0					
9	Frenchman-Cambridge division, Nebr.										N			6.7	10.6	3.6	4.6	5.2	19.8	1.3	9
											S			.5	.9	.4	.4		13.5	1.2	
10	Grand division, S. Dak., Shadehill unit.										N									12.0	10
											S										
	Heart division, N. Dak.:																				
11	Dickinson unit										N					.9					11
											S										
12	Heart Butte unit										N	0.1		5.6	4.5	2.9					12
											S										
13	Helena-Great Falls division, Mont., Canyon Ferry unit.				50.0						N										13
											S										
14	Lower Big Horn division, Mont., Yellowtail unit.							150.0		50.0	N										14
											S										
15	Marias division, Mont., Lower Marias unit.						2.0			1.6	N								12.0	115.0	15
											S										
16	Middle Loup division, Nebr., Sargent unit.									4.4	N					13.6				3.8	16
											S										

Schedule of irrigation and power development—Continued

Line No.	Name and location of project	Schedule of power development—kilowatts (in thousands)									Schedule of irrigation development—acres (in thousands)										Line No.
		Existing 6-30-51	1952	1953	1954	1955	1956	1957	1958	Estimated additional	Type	Existing 6-30-51	1952	1953	1954	1955	1956	1957	1958	Estimated additional	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
	Phase A—Units ready for or under construction—Con.																				
	Missouri-Souris division, N. Dak.:																				
17	Jamestown unit										N									22.0	17
											S										
18	Missouri division unit, Mont.						18.0				N					3.9	4.3	3.0	5.5	89.0	18
											S										
19	Moreau division, S. Dak., Bixby unit.										N									11.0	19
											S										
20	North Dakota pumping division, N. Dak., Fort Clark unit.										N			2.1							20
											S										
	Oregon Trail division, Wyo.:																				
21	Glendo unit							72.0			N										21
											S										
22	Kortes unit	36.0									N										22
											S										
	Smoky Hill division, Kans.:																				
23	Cedar Bluff unit										N				11.5						23
											S										
24	Wilson unit										N									20.0	24
											S										
	Solomon division, Kans.:																				
25	Glen Elder unit										N									26.0	25
											S										
26	Kirwin unit										N						7.8	3.7			26
											S										
27	Webster unit										N									9.0	27
											S										
28	South Platte division, Colo Narrows unit.										N									30.0	28
											S									230.0	
29	Three Forks division, Mont., Crow Creek pump unit.										N				2.0	3.0					29
											S										
30	Transmission division, various.										N										30
											S										

31	Upper Republican division, Colo.-Kans., St. Francis unit.										N						6.0				31
											S						.5				
	Yellowstone division, N. Dak.-Mont.:																				
32	Cartwright unit										N			.8							32
											S										
33	Sadie Flat unit										N									7.1	33
											S										
34	Savage unit										N	2.2									34
											S										
35	Sidney unit										N					1.9					35
											S										
	Subtotal—Phase A	36.0	16.2		50.0		20.0	222.0		55.6	N	2.3	16.5	23.4	38.1	40.6	31.5	44.5	51.0	377.4	
											S		55.7	.5	5.3	26.0	.9		13.5	231.2	
36	Phase B—Units being prepared for construction.							8.0		288.0	N					16.6	22.5	47.5	41.0	1,950.5	36
											S						1.0	17.0	9.6	24.3	
37	Phase C—Continuing work on the general plan of development.									314.0	N						8.7	30.3	29.9	2,572.3	37
											S							49.0	16.7	670.7	
	Total—Missouri River basin.	36.0	16.2		50.0		20.0	230.0		657.6	N	2.3	16.5	23.4	38.1	57.2	62.7	122.3	121.9	4,900.2	
											S		55.7	.5	5.3	26.0	1.9	66.0	39.8	926.2	

NOTE.—N=Full irrigation supply. S=Supplemental irrigation supply.

Appropriations

Appropriations for 1951 were made to the Bureau of Reclamation in conformity with the new appropriation structure as recommended by the House Appropriations Committee. Under the new appropriation structure the Bureau's multifarious activities are grouped into four major appropriation items, namely, General Investigations, Construction and Rehabilitation, Operation and Maintenance, and General Administrative Expenses, with specified amounts to be derived from the Reclamation fund and the Colorado River Dam fund.

These 4 main appropriations replaced 54 appropriation items and unnumbered subitems which appeared in the 1950 Appropriation Act. The language has been streamlined and reduced wherever possible without sacrificing the intent of the Congress. This entirely new language is an improvement in mechanics and not a change in basic policy.

Under the lump-sum provisions of the 1951 Appropriation Act, operations of the Bureau are handled in a fashion similar to the manner in which the Missouri River Basin appropriation has been handled in the past 5 years. Allotments are made to individual projects or activities in accordance with the expressed desires of the Congress, and the expenditures are controlled by a programing and reporting system which has been set up in cooperation with the General Accounting Office to insure that the program moves forward only as approved by the Congress at the maximum rate permissible with available funds.

It is anticipated that requests for deficiency and supplemental appropriations will be minimized somewhat as a limited interchange of allotments within the appropriation is permitted in cases of real emergency; only, however, with the approval of the Secretary of the Interior who is charged with the responsibility of carrying out the intent of the Congress with respect to allocations.

The General Appropriation Act, 1951, was the first omnibus appropriation bill approved by the Congress. However, this type of bill for fiscal year 1952 appropriation was abandoned by the Congress in favor of the appropriation bills for individual agencies such as those types of bills prior to fiscal year 1951.

Regular and supplemental appropriations for the Bureau of Reclamation for fiscal year 1951 totaled $325,494,000. After savings effected by the Bureau of the Budget acting under the mandate of section 1214 of the General Appropriation Act, 1951, the net appropriations available were $271,543,800, a reduction of $53,950,200. Contract authority for $3,000,000 granted to the Bureau in the 1951 appropriation was also withheld by the Bureau of the Budget acting under the authority in section 1214.

Unused balances carried over from fiscal year 1950 plus contributions from other sources and fund adjustments equaled $65,783,863 making a total available for obligation of $337,327,663.

The unobligated funds at the end of fiscal year 1951 carried over into fiscal year 1952 amounted to 32.3 million dollars, something less than the regular 10 percent of the total available for obligation usually allowed as a provision against contingencies and frequently carried over.

Obligations for fiscal year 1951 totaled 305 million dollars or 90.4 percent of the work programed in 1951 as compared with 85.3 percent accomplished in fiscal year 1950.

The limitation on the amount of money which may be used for the performance of work by Government forces (force account work), first imposed upon the Bureau in the 1949 appropriation act, was included again in the 1951 act. The 1951 act carried the same limitation as appeared in the 1950 bill, viz, not to exceed 12 percent of the allotment for any one project with a maximum of $225,000 to be used on any one project or unit of Missouri River Basin.

A limitation of $150,000 in the General Administrative Expenses appropriation was imposed upon expenditures for informational work in 1951. This was the same limitation as appeared in the 1950 act.

The amount appropriated, including all supplementals for fiscal year 1951 for each activity, together with the amount to be derived from the special and general funds, is as follows:

Table 11.—***Condensed statement of appropriations, fiscal year 1951, exclusive of trust funds***

	Amount appropriated	Budget reserve under section 1214	Net appropriation
General investigations	$5,875,000	$375,000	$5,500,000
Reclamation fund	(5,116,000)	(316,000)	(4,800,000)
Colorado River Dam fund: Colorado River development fund	(500,000)		(500,000)
General fund	(259,000)	(59,000)	(200,000)
Construction and rehabilitation [1]	296,928,000	53,195,000	243,733,000
Reclamation fund	(25,135,700)	(1,915,735)	(23,219,965)
General fund	(271,792,300)	(51,279,265)	(220,513,035)
Operation and maintenance	15,491,000	44,200	15,446,800
Reclamation fund	(12,001,400)	(44,200)	(13,872,935)
Colorado River Dam fund	(1,808,000)		(1,808,000)
General fund	(1,681,600)		(1,681,600)
General administrative expenses	7,200,000	336,000	6,864,000
Reclamation fund	(7,200,000)	(336,000)	(6,864,000)
Grand total	325,494,000	53,950,200	271,543,800
Reclamation fund	(49,453,100)		
Colorado River Dam fund	(2,308,000)		
General fund	(273,732,900)		

[1] In addition, appropriation act granted contracting authority in the amount of $3,000,000 which was impounded by Bureau of the Budget under authority in section 1214.

Table 12.—*Annual appropriations*[1] *summary by funds and total expenditures, 1902–51*

Fiscal year	Reclamation fund	General fund[2]	Revenue available	Emergency funds	Permanent appropriation expenditures	Total appropriations	Total expenditures
1906[3]	$17, 363, 800	----------	----------	----------	----------	$17, 363, 800	[4] $12, 658, 163
1907	18, 051, 161	----------	----------	----------	----------	18, 051, 161	12, 533, 916
1908	9, 562, 038	$1, 000, 000	----------	----------	----------	10, 562, 038	11, 799, 956
1909	9, 180, 700	----------	----------	----------	----------	9, 180, 700	10, 390, 395
1910	8, 183, 300	----------	----------	----------	----------	8, 183, 300	10, 050, 733
1911	26, 896, 790	----------	----------	----------	----------	26, 896, 790	9, 556, 325
1912	8, 262, 367	----------	----------	----------	----------	8, 262, 367	11, 663, 193
1913	8, 300, 508	----------	----------	----------	----------	8, 300, 508	8, 791, 905
1914	15, 931, 922	----------	----------	----------	----------	15, 931, 922	10, 437, 941
1915	1, 204, 411	----------	----------	----------	----------	1, 204, 411	14, 213, 173
1916	13, 530, 000	(5)	----------	----------	----------	13, 530, 000	8, 805, 940
1917	8, 887, 557	----------	$15, 000	----------	----------	8, 902, 557	8, 023, 130
1918	8, 227, 000	310, 213	----------	----------	----------	8, 537, 213	8, 982, 355
1919	9, 397, 081	443, 196	----------	----------	----------	9, 840, 277	8, 645, 625
1920	7, 300, 000	548, 927	----------	----------	----------	7, 848, 927	6, 399, 871
1921	8, 463, 000	661, 177	----------	----------	----------	9, 124, 177	10, 034, 149
1922	20, 266, 000	335, 871	----------	----------	----------	20, 601, 871	8, 760, 134
1923	14, 800, 000	559, 530	----------	----------	----------	15, 359, 530	10, 045, 703
1924	13, 800, 000	314, 067	----------	----------	----------	14, 114, 067	11, 873, 766
1925	11, 890, 809	----------	----------	----------	----------	11, 890, 809	10, 869, 452
1926	12, 563, 240	50, 000	----------	----------	----------	12, 613, 240	8, 906, 138
1927	7, 436, 320	75, 000	----------	----------	----------	7, 511, 320	7, 449, 552
1928	12, 148, 800	50, 000	----------	----------	----------	12, 198, 800	8, 636, 998
1929	14, 138, 400	115, 000	190, 000	----------	----------	14, 443, 400	10, 254, 937
1930	8, 253, 000	10, 760, 000	390, 000	----------	----------	19, 403, 000	10, 995, 304
1931	9, 087, 000	100, 000	395, 000	----------	----------	9, 582, 000	13, 942, 762
1932	6, 971, 000	25, 100, 000	300, 000	----------	----------	32, 371, 000	26, 345, 915
1933	2, 442, 288	13, 050, 000	375, 000	----------	----------	15, 867, 288	25, 204, 914
1934	3, 003, 000	8, 048, 000	405, 000	$103,535,000	----------	114, 991, 000	24, 751, 833
1935	860, 750	----------	316, 000	34, 076, 000	----------	35, 252, 750	40, 882, 912
1936	1, 022, 100	20, 950, 000	366, 000	25, 438, 000	----------	47, 776, 100	49, 849, 120
1937	12, 028, 600	36, 850, 000	666, 000	−4, 873, 000	----------	44, 671, 600	52, 379, 804
1938	11, 991, 600	[6] 30, 670, 000	831, 000	39, 547, 500	$1, 100, 000	84, 140, 100	65, 405, 810
1939	10, 574, 600	32, 995, 000	866, 000	−5, 002, 488	4, 600, 000	44, 033, 112	79, 329, 428
1940	13, 269, 600	63, 715, 000	1, 181, 000	23, 334	5, 700, 000	83, 888, 934	96, 365, 934
1941	9, 429, 600	63, 765, 000	1, 339, 000	−119, 287	6, 600, 000	81, 014, 313	85, 596, 484
1942	7, 446, 600	93, 915, 031	1, 414, 400	−19, 965	2, 600, 000	105, 356, 066	91, 438, 941
1943	2, 651, 060	87, 076, 210	1, 936, 400	−1, 127	2, 600, 000	94, 262, 543	69, 287, 440
1944	2, 422, 500	35, 853, 000	3, 335, 075	−72, 709	5, 669, 468	47, 207, 334	54, 587, 242
1945	5, 321, 000	19, 324, 200	3, 278, 800	−22, 332	5, 282, 501	33, 184, 169	50, 376, 076
1946	34, 089, 290	84, 970, 500	3, 578, 600	----------	4, 491, 718	127, 130, 108	64, 362, 688
1947	36, 315, 968	77, 846, 135	3, 284, 245	−30, 396	4, 806, 879	122, 222, 831	123, 142, 887
1948	20, 127, 250	117, 508, 288	5, 549, 500	----------	5, 545, 400	148, 730, 438	176, 153, 466
1949	29, 952, 663	229, 251, 503	6, 999, 601	----------	5, 293, 475	271, 497, 242	243, 794, 856
1950	35, 447, 705	313, 557, 275	9, 327, 097	----------	8, 034, 825	366, 366, 902	298, 373, 537
1951	(7)	271, 543, 800	(7)	----------	[8] 5,502,086	277, 045, 886	[8] 348, 793, 030
Total	548, 492, 378	1, 641, 311, 923	46, 338, 718	192, 478, 530	67, 826, 352	2, 496, 447, 901	2, 331, 143, 833

[1] Including allotments from the Reclamation fund through 1915; authorizations for increased compensation from general fund, 1918 through 1924, power and other revenues made available; and allocations from emergency funds 1934–44.

[2] General fund includes appropriations for operation and maintenance of the Colorado River front work and levee system and for the Colorado River Dam fund.

[3] Allotments prior to 1906 were canceled on July 27, 1907, at Fallon, Nev., and summary allotments issued in lieu thereof.

[4] Total expenditures for 1903–06, as follows: 1903 -$269,094; 1904—$1,513,431; 1905—$3,767,922; 1906—$7,107,716.

[5] Excludes appropriation of $100,000 to Secretary of the Interior for Imperial Valley protection.

[6] Includes appropriation of $100,000 to Bureau of Reclamation for Bonneville.

[7] All funds merged into the general fund appropriation in fiscal year 1951.

[8] Estimate.

Reports

Reporting methods and reports covering analyses of progress on the Bureau's programs for General Investigations, Construction and Rehabilitation, and Operation and Maintenance, operating financial and personnel statistics and preparation of periodicals and publications were further improved during the year to meet minimum administrative and top management requirements.

Table 13.—*The Reclamation fund, 1950–52, funds available for appropriation*

	Actual 1950	Actual 1951	Estimated 1952
Unappropriated balance brought forward (as of June 30)	$41,128,209	$32,136,457	$40,828,300
Accretions and collections:			
Bureau of Reclamation, 100	9,251,558	8,893,499	----------
Other agencies, 200	10,041,395	17,929,996	----------
Reclamation fund, power revenues, 300	17,023,785	29,417,040	----------
Total accretions and collections	36,346,738	56,240,535	----------
Total available for appropriation	77,444,947	88,376,992	----------
Less:			
Appropriated for refund of revenue collections	14,985	398,154	----------
Appropriated for farmers irrigation district, North Platte project, Nebraska	----------	6,575	----------
Appropriated collections returned to receipts	672,066	----------	----------
Add: Lapsed appropriations	129,796	2,309,137	----------
Deduct appropriation or estimate for general investigations	3,700,000	5,116,000	----------
Investigations, upper Colorado River Basin	500,000	----------	----------
Advance planning	50,000	----------	----------
Construction and rehabilitation	----------	25,135,700	----------
Construction	21,853,063	----------	----------
Rehabilitation and betterment of existing projects	2,500,000	----------	----------
Operation and maintenance	11,783,072	12,001,400	----------
General administrative expenses	----------	7,200,000	----------
Salaries and expenses	4,365,100	----------	----------
Emergency fund	----------	----------	----------
Total appropriation or estimate	44,751,235	49,453,100	----------
Balance carried forward	32,136,457	40,828,300	----------

For progress analyses, the monthly fund and Cost Data Digest of prior year, limited to the Construction and Rehabilitation program was expanded to include General Investigations and Operation and Maintenance programs and retitled Activities Digest. Available to the Commissioner's Office in summary form by the 15th of the month following the report month, it reports monthly on progress made on each activity, Bureau-wide, in terms of costs and funds. With this timely report as the base, the Bureau's monthly progress report, complete with supplementary data, was prepared for administrative and for interim statistical reference purposes pending compilation of annual data and for records. Likewise, the quarterly program accomplishment letters which summarize performances complete with analyses, interpretation, and trends for each region were prepared for management purposes. A series of display charts illustrating progress on accomplishments and related items were developed and maintained for visual ready-reference and conference purposes. More sensitive reporting on anticipated changes in scheduled actions was developed by adding forecast of flagged action changes to the established Flagged Action reporting routine. Among other purposes, the revision provides for establishing advance schedules for critical materials requiring priorities.

The summary cost and progress monthly reporting system for all activities and the monthly reports on status of construction and supply

Table 14.—*Accretions to Reclamation fund by States, fiscal year 1951*

State	Sale of public lands		Proceeds from oil leasing act		Total to June 30, 1951
	Fiscal year 1951	To June 30, 1951	Fiscal year 1951	To June 30, 1951	
Alabama		$4,372.65	$79.80	$199,092.35	$203,465.00
Arizona	$30,725.53	2,879,885.69	9,164.74	75,564.02	2,955,449.71
Arkansas			36.75	2,783.08	2,783.08
California	206,611.40	8,841,032.30	3,778,542.82	43,233,501.58	52,074,533.88
Colorado	35,257.62	10,551,778.61	2,157,470.90	10,117,895.16	20,669,673.77
Florida				126.00	126.00
Idaho	90,256.67	7,294,546.16	78,533.02	246,639.87	7,541,186.03
Illinois			21.00	21.00	21.00
Kansas	2,180.83	1,039,906.13	45,444.64	153,489.37	1,193,395.50
Louisiana			10,602.71	424,617.00	424,617.00
Michigan			1,629.13	11,095.98	11,095.98
Mississippi			1,523.54	3,649.10	3,649.10
Montana	75,404.80	15,622,465.73	676,432.28	5,162,404.19	20,784,869.92
Nebraska	30,913.81	2,156,550.94	3,931.01	6,808.80	2,163,359.74
Nevada	11,922.77	1,105,919.82	376,717.75	454,262.33	1,560,182.15
New Mexico	14,283.23	6,919,217.90	1,986,581.03	15,844,395.69	22,763,613.59
North Dakota	7,156.26	12,245,989.54	40,538.78	402,801.70	12,648,791.24
Oklahoma	3,564.44	5,951,071.22	42,470.89	89,368.59	6,040,439.81
Oregon	252,892.86	12,594,765.69	1,419.99	10,550.46	12,605,316.15
South Dakota	4,241.22	7,747,069.05	49,482.89	97,674.28	7,844,743.33
Utah	42,874.58	4,540,244.14	513,037.28	3,543,035.78	8,083,279.92
Washington	202,803.02	7,874,373.34	2,196.00	50,427.36	7,924,800.70
Wyoming	27,925.54	9,108,774.21	5,777,358.52	67,799,846.61	76,908,620.82
Total	1,039,014.58	116,477,963.12	15,553,215.57	147,930,050.30	264,408,013.42
Proceeds, Federal water-power licenses					[1] 1,165,897.50
Proceeds, potassium royalties and rentals					[2] 4,558,220.00
Receipts from Naval petroleum reserves, 1920–38, act of May 9, 1938					29,778,300.23
Proceeds from rights-of-way over withdrawn lands, act of July 19, 1919					[3] 10,550.64
Lease of lands					[4] 31,980.39
Town lot sales					[5] 723,545.73
Timber sales, and other miscellaneous items					[6] 158,688.95
Grand total					300,835,196.86

[1] Proceeds for fiscal year, $417.33.
[2] Proceeds for fiscal year, $1,156,765.64.
[3] Proceeds for fiscal year, $148.85.
[4] Proceeds for fiscal year, $21,064.46.
[5] Proceeds for fiscal year, $680.20.
[6] Proceeds for fiscal year, $158,688.95.

contracts were maintained. Monthly tabulations of estimated unobligated year-end funds were issued as in prior years and monthly tables of year-end unexpended funds were compiled for management and budgetary use. Establishment of a centralized statistical record system was initiated. Among various compilations of ready reference statistical tables, a record of investments, benefits, and pertinent data, by States, was progressed.

With the elimination of the Bureau of the Budget personnel ceiling control, procedures for continuing under a Commissioner's Personnel Ceiling were established. The routine was effectively used to bring about orderly reduction in employment from approximately 19,000 in early July 1950 to 16,500 in June 1951 in pace with the leveling off of fiscal year 1951 annual program and in anticipation of a smaller program for fiscal year 1952 governed by defense needs. A plan was developed to eliminate need for personnel ceiling procedures. Under this plan, personnel requirements will be related to approved project control schedules and internal office budgets, in terms of man-years and personal services funds. Limitations will be established in accordance with budgets and be funded, accounted and reported upon using manual prescribed documents, accounting procedures, and report forms. Personnel statistical reports were reduced to a minimum, eliminating all unessential reporting. Display charts were maintained for employment and its trend. The Activity and Object Expenditure Report serving as a stopgap measure pending adoption of a more substantial accounting and reporting device on costs involved in general expenses, was continued through the year.

Federal Power Commission FPC 1 report series, the annual power reports required by law under the Boulder Canyon Project Adjustment Act and Fort Peck Project Act, and the Bureau's Annual Consolidated Operating Statement of Bureau of Reclamation Power Systems were compiled. Likewise the Bureau's Washington Report, a periodical for acquainting all employees with important news and policy matters, was issued on its biweekly schedule.

COMPTROLLER

The Office of the Comptroller pursued the delegated functions of consultative and advisory service to the Commissioner and top staff of his office and continued the development of expanding and more effective auditing activity. At the beginning of the year a reorganized plan of audit administration was instituted with the Commissioner's approval. This plan was designed to provide for maximum audit production in the face of very limited potential in terms of staff numbers. The plan has been productive and the past year witnessed a degree and quality of performance heretofor unattained.

Because of the competition for trained professional accounting personnel and the resulting difficulty of recruitment, the lapse factor in the field audit staff was unusually high. Recent intensification of recruitment efforts has largely overcome this situation. As a direct outgrowth of the staffing problem, however, it was impossible to effectuate one phase of the reorganized approach; namely, the establishment of resident auditors. This phase of the operation has not been abandoned, but its accomplishment is directly dependent upon budgetary and recruitment factors.

Eighty-five auditing assignments were undertaken which included, in addition to comprehensive project audits and water users audits, special analyses of representative projects pertaining to stores and equipment, work order system, salaries and expenses, budget and costing practices, vouchering operations, and power operations.

Table 15.—*Investment in plant and property as of June 30, 1951*

State or territory	Project and/or activity	Completed works: Multi-purpose (1)	Completed works: Irrigation (2)	Completed works: Electric (3)	Completed works: Municipal water plant (4)	Completed works: Other plant (5)	Construction in progress (6)	Other physical property (7)	Total (8)
Alaska	Eklutna						$709, 610		$709, 610
Arizona	Gila		$14, 288, 554				6, 302, 349		20, 590, 903
	Salt River	$17, 659, 556							17, 659, 556
	Boulder Canyon:								
California-Arizona	All-American Canal system		46, 719, 952			[1] $4, 547, 912	5, 884, 500	$441, 659	57, 594, 023
Nevada-Arizona	Hoover Dam, power plant and appurtenant works.	94, 350, 823		$50, 772, 359			7, 970, 239	5, 792, 651	158, 886, 072
Arizona-California-Nevada	Colorado River front work and levee system					[1] 6, 367, 063	110, 203		6, 477, 266
Arizona-California	Parker Dam power	6, 926, 204		16, 642, 988			314, 869		23, 884, 061
	Yuma		5, 362, 143	414, 194					5, 776, 337
	Yuma auxiliary		1, 258, 891						1, 258, 891
Arizona-Nevada	Davis Dam and power plant			5, 271, 558			94, 812, 584		100, 084, 142
California	Cachuma						10, 138, 045		10, 138, 045
	Central Valley	175, 286, 288	50, 294, 159	53, 912, 173			63, 144, 142		342, 636, 762
	Orland		2, 523, 271				20, 331		2, 543, 602
	San Diego				$269, 485				269, 485
Colorado	Colorado-Big Thompson	61, 768, 288		18, 929, 925			23, 018, 966		103, 717, 179
	Fruitgrowers Dam		200, 309						200, 309
	Grand Valley		4, 708, 379	213, 669			673, 847		5, 595, 895
	Mancos		3, 835, 250				5, 603		3, 840, 853
	Paonia						1, 403, 640		1, 403, 640
	Pine River		3, 358, 428					11, 511	3, 369, 939
	San Luis Valley						2, 708, 822		2, 708, 822
	Uncompahgre		5, 930, 234						5, 930, 234
Idaho-Oregon	Boise:								
	Arrowrock and Payette	1, 791, 722	12, 859, 992	2, 000, 794			16, 114, 043		32, 766, 551
	Anderson ranch dam	24, 775, 463					4, 704, 047		29, 479, 510
Idaho	Preston Bench		449, 214						449, 214
	Rathdrum prairie:								
	Hayden Lake		118, 409						118, 409
	Post Falls		363, 951						363, 951
	Lewiston orchards	426, 999	1, 028, 014		990, 793				2, 445, 806
	Mann Creek							35, 446	35, 446
Idaho-Wyoming	Minidoka	765, 101	20, 528, 497	2, 126, 075			974, 333	108, 331	24, 502, 337
	Palisades						2, 461, 886		2, 461, 886

Montana	Bitter Root		955,051				26,079		981,130
	Bitterroot Valley—Woodside						88,703		88,703
	Buffalo Rapids—first division		2,017,173				101,575		2,118,748
	Buffalo Rapids—second division		1,461,157				720,162		2,181,319
	Frenchtown		290,797						290,797
	Hungry Horse						56,859,620		56,859,620
	Huntley		1,490,109						1,490,109
	Intake		92,371						92,371
	Milk River	7,519,067	(486,101)				300,064		7,333,030
	Missoula Valley		278,255				10		278,265
	Sun River	7,168,432	2,561,831				50,784		9,781,047
Montana-North Dakota	Fort Peck power			4,474,514			2,536,092		7,010,606
	Lower Yellowstone		3,240,874						3,240,874
Nebraska	Mirage Flats		3,156,123				82,789		3,238,912
Nebraska-Wyoming	North Platte	3,408,012	14,898,729	898,997			721,134		19,926,872
Nevada	Humboldt		1,214,321						1,214,321
	Newlands		2,992,461	344,343					3,336,804
Nevada-California	Truckee storage		1,092,423						1,092,423
New Mexico	Carlsbad		3,623,850				25,541		3,649,391
	Fort Sumner						2,369,425		2,369,425
	Hondo		371,788						371,788
	Tucumcari		15,046,169				1,533		15,047,702
New Mexico-Texas	Rio Grande		10,304,650	12,685,978			448,077		23,438,705
	Rio Grande—river rectification		180,628						180,628
North Dakota	Buford Trenton		672,392				549,137		1,221,529
Oklahoma	W. C. Austin		12,147,057				111,291		12,258,348
Oregon	Arnold						205,527		205,527
	Baker		281,589						281,589
	Burnt River		601,026						601,026
	Deschutes—north unit		10,659,252	515,304			464,514		11,639,070
	Grants Pass		100,000						100,000
	Ochoco						834,513		834,513
	Umatilla		4,352,107					58,898	4,411,005
	Vale		4,857,670				101,580		4,959,250
Oregon-California	Klamath		10,918,984				1,523,431	12,066	12,454,481
Oregon-Idaho	Owyhee		18,167,046				622,226	107,007	18,896,279
South Dakota	Belle Fourche	1,844,882	1,210,046				462,332		3,517,260
	Rapid Valley	928,547							928,547
Texas	Balmorhea		437,674						437,674
	Colorado River	23,496,993		464,801					23,961,794
Utah	Hyrum		953,854						953,854
	Moon Lake		1,599,359						1,599,359
	Newton		712,691						712,691
	Ogden River		4,463,221				265,048		4,728,269
	Provo River		19,940,340				6,478,342		26,418,682
	Sanpete		374,540						374,540
	Scofield		944,125						944,125
	Strawberry Valley		3,337,463	91,969				61,086	3,490,518
	Weber River		2,725,885						2,725,885

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[1] Flood control plant in service.

Table 15.—*Investment in plant and property as of June 30, 1951*—Continued

State or territory	Project and/or activity	Completed works					Construction in progress	Other physical property	Total
		Multipurpose (1)	Irrigation (2)	Electric (3)	Municipal water plant (4)	Other plant (5)	(6)	(7)	(8)
Washington	Columbia Basin	$139,744,497	$2, 525, 491	$95, 517, 844			$164,612,927	$1, 562, 630	$403, 963, 389
	Okanogan		500, 084	5, 736					505, 820
	Yakima		42, 448, 264	600, 844			2, 027, 279		45, 076, 387
Wyoming	Eden						1, 100, 163		1, 100, 163
	Kendrick	4, 865, 653	8, 826, 750	4, 441, 757			3, 536, 713		21, 670, 873
	Riverton	9, 205, 639	4, 723, 426	410, 529			2, 167, 084		16, 506, 676
Wyoming-Montana	Shoshone	9, 147, 185	4, 954, 025	3, 248, 207			1, 023, 846		18, 373, 260
Various	Missouri River Basin	59, 825, 434	5, 913, 079	3, 765, 838			96, 370, 341		165, 874, 692
	Soil and moisture conservation						43, 985	86, 658	130, 643
	Unallocated costs							4, 202, 308	4, 202, 308
	Total	650, 904, 785	407, 957, 743	277, 750, 396	$1, 260, 278	$10, 914, 975	588,303,926	12, 480, 250	1, 949, 572, 354

As heretofore, the field audit activity of the Comptroller covered (1) financial audits of various types relating to the financial operations of Bureau projects; (2) selected audits of water users' organizations having contractual relationships with the Department; and (3) special audits dealing with cost allocations in joint venture construction, construction contract claims, and many other subjects bearing upon the financial program of the Bureau.

Ancillary to the audit work, the Comptroller's staff discharged its functions of financial policy and review in matters of repayment contracts, analyses of rate schedules, municipal finance and management, interagency agreements, external audit, and investigational reports and legislation. The auditing and review functions of this office have now progressed to a point at which there is positive integration between field examinations and policy review.

In summary, the Comptroller's functions have been stabilized by a well-founded, precise program. This development is of particular significance in the audit activity in which the work has progressed beyond the experimental and pilot type operation to a phase of systematic, effective performance.

LEGISLATION

At the close of the 1950 fiscal year several legislative bills affecting the Bureau of Reclamation were pending before the Congress. Some of these bills were enacted during the latter part of the second session of the Eighty-first Congress, others were in various stages of the legislative process when the Eighty-first Congress adjourned *sine die* on January 2, 1951.

Among the enacted bills were five measures which authorized the construction of projects by the Department of the Interior on the basis of plans prepared by the Bureau of Reclamation.

The first such project authorized by the Congress during the fiscal year 1951 was the Eklutna project in Alaska (Public Law 628, 81st Cong., act of July 31, 1950). This hydroelectric power project is in the vicinity of Anchorage, Alaska, and will supply an area in which there is a shortage of electric energy. Although the project is not a Federal Reclamation project, the Secretary on September 1, 1950, designated the Bureau of Reclamation as the agency charged with the construction, operation, and maintenance of the project.

The act of September 26, 1950 (Public Law 839, 81st Cong.), reauthorized the Central Valley project so as to include certain irrigation canals in the Sacramento Valley as an integrated part of that project. Studies on such canals were commenced prior to the study of the initial features of the Central Valley project. It was estimated that the canals would not be required for approximately 25 years; therefore, they were excluded from the initial project authorization in

1935. The increase in agricultural development in California during the World War II years, plus the unprecedented population increases brought the demand for these canals into existence about 10 years ahead of the anticipated time.

The construction, operation, and maintenance of the Vermejo project in New Mexico as a Federal Reclamation project was authorized by the act of September 27, 1950. The project, which was originally privately owned and operated, had deteriorated to such an extent that only a part of the lands could be irrigated. It was no longer self-sustaining and the resources of the local interests were insufficient for the installation of necessary improvements. In order to preserve the established economy of the area authorization of extensive and effective rehabilitation measures by the Federal Government was necessary.

Authorization of the Palisades Dam and Reservoir project and the North Side Pumping Division and American Falls power plant of the Minidoka project was accomplished by the act of September 30, 1950 (Public Law 864, 81st Cong.). Enactment of this legislation constituted a long step forward in the development of the water resources of the Upper Snake River Valley in Idaho and in the settlement of an extremely complicated water-right problem in that area.

Public Law 898 of the Eighty-first Congress (act of December 29, 1950) authorized the Canadian River project, Texas. The primary purpose of the project is to furnish a reliable municipal and industrial water supply to 11 cities and towns in the Panhandle-South Plains area of northwest Texas which are now dependent upon a rapidly declining ground water supply. Benefits relating to irrigation, flood control, and fish and wildlife will also be served.

In addition to the above laws, which authorized the construction of projects by the Department, other measures directly affecting the Bureau of Reclamation were enacted by the Congress.

Two more amendatory repayment contracts, negotiated pursuant to section 7 of the Reclamation Project Act of 1939, were authorized by the Congress to be signed by the Secretary. Public Law 666 and Public Law 667, both approved by the President on August 5, 1950, authorized amendatory repayment contracts with the Ogden River Water Users' Association, Ogden River project, and the South Cache Water Users' Association, Hyrum project, respectively.

Other enactments during the latter part of the Eighty-first Congress included: Public Law 713, authorizing the granting of easements and rights-of-way by the United States without restriction to their duration; Public Law 750, authorizing credits to certain agencies in the United States for costs of construction and operation and maintenance of flood protective levee systems along or adjacent to the lower Colorado River; Public Law 832, providing for the transfer of a sewerage system to the town of Mills, Wyo.; Public Law 840, amending the Columbia Basin Project Act so as to extend the time during which landowners within the project may sign recordable contracts and by permitting certain landowners to bring their lands back in the project; and Public Law 851, concerning the sale of State land within the Columbia Basin project.

No legislation was enacted by the Congress affecting the Bureau of Reclamation during the latter half of the fiscal year 1951.

Litigation

Attorneys in the Office of the Chief Counsel in Washington, D. C., and in the offices of the various regional counsel devoted many hours in fiscal year 1951 to problems arising out of litigation involving the Bureau of Reclamation. Assistance was given to the Department of Justice in the conduct of trials in numerous cases and in the preparation of legal briefs, arguments, stipulations, and proposed settlements.

Soon after the Supreme Court of the United States had rendered its opinion in the action *United States* v. *Gerlach Live Stock Co.* and related cases (339 U. S. 725) it was necessary to devote a considerable amount of attention to various proposals to settle or enter into stipulations in the *Will Gill* and three related actions which were pending on the docket of the Court of Claims. These actions were instituted to recover damages for the taking of water of the San Joaquin River by the construction and operation of Friant Dam, Central Valley project, California. A proposed statement of facts is being considered by the Department of Justice and this Department.

Work continued on the actions filed by owners of land bordering the channels of the San Joaquin River below the mouth of the Merced River for alleged damages to their water rights. These actions, known as the *W. F. Brush* and 16 related actions, involve a demand for the sum of $1,287,000 with interest from the date of alleged taking. Consideration is being given to an offer of settlement of these actions.

Proposed findings of fact, conclusions of law, and decree of the special master in the case of *United States* v. *Alpine Land & Reservoir Co.* were submitted to Judge Roger T. Foley of the United States District Court for the District of Nevada. This action affects the water rights of the United States in Carson River for the Newlands project.

In December 1950 the United States District Court for the District of Colorado decided that it had jurisdiction to hear the action by the United States against the Northern Colorado Conservancy District, the city and county of Denver, and others. Since that time numerous motions to strike, make more certain, and other motions have been heard. No answers have been filed in the case except on behalf of the

Public Service Co. of Colorado. The total number of defendants in the action is approximately 200.

An action was commenced against the United States in the Fourth Judicial District Court for Utah by Mr. and Mrs. M. H. North for damage allegedly due to the high water elevation of the Deer Creek Reservoir of the Provo River project. That action, later transferred to the Federal Court of Utah, culminated in a decree of no cause of action.

In May 1947 the United States and the Frenchman-Cambridge irrigation district at Cambridge, Nebr., entered into a repayment contract in connection with a unit of the Missouri River Basin project. As required by the Federal reclamation laws, the irrigation district thereafter filed an action in the District Court of Red Willow County, at McCook, Nebr., asking for approval and confirmation of the contract. However, the hearings thereon were not held by the court until February 1950.

On July 19, 1950, the court rendered an opinion approving the contract in part and disapproving or rejecting it in part by holding, in effect, that the excess land provisions of reclamation law could not apply to those lands which had vested water rights acquired under independent appropriations, that the United States could not claim waste, seepage and flow rights for the irrigation water involved, and that the Secretary of the Interior did not have a right to make rules and regulations with reference to water use and soil conservation practices.

The irrigation district then filed a motion to set aside this decree on the grounds that the court not only misapplied the Nebraska law but that it was beyond the jurisdiction and authority of the court to render a decision approving the contract in part and disapproving it in part under the issues and the law applicable thereto, and the decree was inconsistent on its face, and that it would not, in any event, apply to the United States. The motion was overruled and the irrigation district appealed to the Supreme Court of Nebraska.

This Department obtained permission from the Department of Justice to file a brief *amicus curiae* on behalf of the United States although the United States was not a direct party in the action. Oral arguments were held before the Nebraska Supreme Court and the court filed an opinion in which it was held that the motion to set aside the decree was in the nature of a motion for a new trial, and, as such, had not been filed in time. Hence the court did not pass on the merits of the case. After extensive conferences the repayment contract was amended; as amended it was submitted to the district court at McCook, Nebr., for a reconfirmation, and an order confirming the contract as amended was granted.

After protracted negotiations with reference to a proposed repayment contract with the Kansas Bostwick irrigation district at Courtland, Kans., a contract was executed in final form on April 20, 1951. Shortly thereafter the irrigation district filed an action in the State district court at Belleville, Kans., wherein approval and confirmation of the contract was requested. Opposition to the confirmation developed and a hearing before the court was held in Belleville, Kans. The hearings were continued in the fiscal year 1952. The main point involved is an attempt on the part of the objectors to obtain an injunction restraining the board of directors of the irrigation district from proceeding with the confirmation proceedings on the grounds that the 1951 amendment to the irrigation laws of Kansas was unconstitutional. The 1951 amendment involved provides in part that before a contract may be confirmed by the district court having jurisdiction, the board of directors of an irrigation district must file with the court a proposed tax schedule which shall show the assessments proposed for each individual tract of land in the district for the entire period to be covered by the contract. The amendment also requires the district court to consider the proposed tax schedule with reference to the benefits to be derived from the construction of the proposed works involved.

MANAGEMENT PLANNING

Management emphasis continued to be directed toward obtaining maximum effectiveness and economy in employee utilization, with satisfactory and encouraging results. Particular attention was given to the simplification of organizational arrangements and operating procedures.

A Bureau-wide "reduce the cost of doing business" program, involving the participation of virtually every employee in a critical review and analysis of operating methods and practices, was carried out. Improvements realized by this program involved monetary benefits of an estimated $3,000,000.

Management appraisals of Bureau operations were conducted in regions 1 and 5 and initiated in regions 6 and 7.

A program for the development of work measurement and staffing standards criteria was initiated.

The initial edition of the Reclamation Manual of administrative and technical instructions was completed. A survey of its use outside the Bureau revealed that nearly 50 foreign governments have requested copies, in addition to numerous other Federal, State, and local governmental agencies, universities and colleges, and private engineering firms.

The review and improvement of forms and reports, and of the procedures governing their use, was continued. This systematic examination resulted in the elimination of some reports and forms and the more effective utilization of many others. The program for controlling and improving forms was initiated in two additional regions.

PERSONNEL

Restricted by Bureau of the Budget personnel ratios placing limitations on the number of employees who could be engaged on personnel work, the Bureau personnel staffs concentrated on planning and developing a forward-looking personnel management and development program. New staff development programs successfully piloted were the accountant trainee program in two regions, and the hydrologists inventory and training program in region 7. The construction engineer development program was hampered by no new starts but it is broadening into an executive development and placement program. Rotation of beginning engineers spread in the field and was very successful where tried. The student engineer and administrative trainee program instigated 2 years ago was continued. An expanded power operation training program was adopted in several hydroelectric plants.

Due to the present emergency the Bureau's construction program was curtailed; however, reduction-in-force of personnel was largely avoided by voluntary turn-over and internal placement. Turn-over during the year was high and recruitment was difficult in the beginning engineer, draftsman, and other lower-grade groups because of inflation and higher pay in private industry. New college graduate engineers were offered 15 to 50 precent higher pay than the GS–5 rating offered by Civil Service. The Central Board of United States Civil Service Examiners for the Bureau processed 42 percent as many applications and placed 33 percent as many persons as in the previous year. There was a slight increase in student engineers last summer to 242. This summer one-third of last year's GS–4's are expected to return as GS–5's.

Labor-management negotiations arriving at mutually satisfactory hourly rates of pay and working conditions were successfully carried out for the Columbia Basin project. A representation election was held on the combined Parker-Davis Dam projects resulting in the designation of the Colorado River Power Trades Council as the representative of the majority of ungraded employees for the development of the collective-bargaining type of labor agreement. Although wage-rate changes were numerous because of apprehension concerning wage stabilization, the Bureau of Reclamation Wage Board was able to keep the Bureau's wage schedules alined with the local prevailing rates.

Work stoppages among the 25,000 contractor's employees were negligible and did not disrupt construction schedules. Relations continue to improve between contractors, their employees, and the Bureau.

The Bureau's safety program was continued and further intensified in region 6 by establishing motor vehicle driver training tests. Safety inspections were performed in all Bureau operations and a program of safety education was continued. The Federal employees health program was continued in its pilot stage at the Denver Federal Center.

Additional and greater delegations have been made to regional directors authorizing them to make appointments and status changes, excepting a few key positions, in all positions up to and including grade GS–15. Classification authority of regional directors also has been increased from GS–11 to GS–13 level. Emphasis was placed upon position classification of the Bureau positions for currency of descriptions and grade allocations to insure equitable treatment of personnel. Through Presidential directive further study was devoted to top positions and recommendations again made for the allocation of certain positions to the new grades GS–16, 17, and 18 levels established under the Classification Act of 1949. Contacts with field installations were expanded by both the Washington and Regional Offices to keep abreast of reorganizations and to place positions on a current and accurate basis. Time was devoted in working with the United States Civil Service Commission on proposed Civil Service Class Specifications and with various Regional Civil Service Classification inspection teams in classification inspections which were enlarged upon during the fiscal year. With further delegations to Regional installations a review of policies and procedures was undertaken to change and/or supplement existing policy. Due to the emphasis placed upon the point 4 program, new procedures were developed and installed to handle this new phase of work.

Twenty-one inspections were made of regional, district, and project offices. The coverage of the inspections was broadened during the year and the regions were required to apply region-wide the results of each inspection.

On June 30, 1951, the Bureau had on the rolls 16,595 full-time employees, 12,860 of whom were under the Classification Act and 3,735 under the wage boards. Of this number 8,612 were entitled to veteran's preference; 2,300 were women.

SUPPLY

Aircraft Operations

The Bureau of Reclamation maintained and operated a fleet of 8 aircraft consisting of 1 twin-engine, 10-passenger Lockheed Lodestar; 2 twin-engine, 5-passenger Beechcrafts; 4 single-engine, 3-passenger Ryan Navions; and one Bell Helicopter.

The Lodestar, assigned to the Washington Office, was used to transport Departmental and Bureau officials and Members of Congress to observe construction and operation of Bureau dams, power plants, canals, transmission lines and other structures, many of which are located in areas not served by regular commercial airline transportation. These visits were made in a minimum of time and at a cost equal to or less than that of commercial transportation.

The two Beechcrafts, assigned to regional offices, were used to transport regional staff personnel to areas not generally served by commercial air transportation, for inspection of proposed transmission line rights-of-way and surveillance of floodwater conditions. They were used very successfully for aerial photographic surveys of features of various Bureau projects and particularly in photographically recording the changing regime of river channels affected by Bureau construction and operations.

During the past fiscal year, four new Ryan Navion aircraft were acquired replacing the single-engine Fairchild airplanes which proved inadequate. They were assigned to various district and regional offices. These aircraft have proved extremely valuable inasmuch as they can be landed in relatively small areas and have provided means of transportation directly to many construction sites in a much shorter time and at lower cost than could be afforded by surface transportation. The airplanes were also used for aerial inspection and aerial photography of Bureau projects.

The Bell Helicopter, assigned to the Parker Dam power project in region 3, was used for regular scheduled flights patrolling 1,522 miles of high-voltage transmission lines. This type of aerial patrol has proved superior to ground patrol for location of trouble and determining condition of conductor, devices, insulators, and crossarms due to better visibility. Speedy location of faults and reporting via mobile radio has reduced loss of revenue due to line outages. The net savings have resulted from reduction in personnel required for line patrol work and transportation costs of vehicles over mountainous and desert terrain. This aircraft also proved excellent for reconnaissance and location work.

Procurement Division

The increasing tempo of the national defense effort and the consequent shortages of critical materials made increasingly difficult the procurement of those materials needed to carry forward Bureau construction programs. Current work of the Bureau was in general restricted to that work which contributed to the national defense and the building up of the civilian economy of the West.

The Defense Electric Power Administration was established as claimant agency through which the Bureau presents its requirements to NPA for materials for its power developments. This agency screens our requirements in their relation to power needs and other materials requirements of the electric power industry. No serious disruptions of the essential power programs occurred although a number of hampering delays were encountered. Some delays resulted from the unavoidable hasty preparation of first submissions of our materials requirements. The result was submission of less than fully adequate justifications in some cases.

To insure proper handling the Bureau established a number of material control offices in the field which were given the responsibility of collecting and compiling current requirements for critical materials and preparing full and complete statements of essentiality as justifications for requests for allocations. All requests for allocations and for assistance in procuring critical materials were cleared through, and controlled by, these offices. This proved to be the only feasible method of handling under this Bureau's decentralized plan of procurement and operation. One of the most essential jobs of the Bureau, from the standpoint of early production of electric power to supplement the supply in a critical area, is the Hungry Horse project in Montana. This project was granted a firm authorization to extend priority ratings to secure needed critical materials to be used in the structure in an amount not to exceed 8 million dollars.

Defense demands upon industry are having the effect of increasing the difficulty of procuring needed equipment particularly in the heavier items aside from the problems of critical materials.

Suppliers demanded extended time for deliveries and escalation provisions to cover possible changes in material and labor costs. This required progressively earlier initiation of procurement for essential items in anticipation of program needs.

The national shortage of rail cars caused some serious delays in delivery to construction jobs of large quantity needs of materials. Particularly cement and aggregate is required in large lots and in smooth flow to avoid disruption of construction work on the larger structures such as dams. This flow of materials is dependent upon the availability of rail cars.

The result of extensive efforts made to divert some of the Bureau's business to small business concerns indicates that 30 percent of purchases made through formal advertising and 70 percent of open market purchases were made from small business firms.

Property Management Division

Property inventory procedures were simplified by elimination of requirements for detailed inventory of all noncapitalized items. This applies to property costing $50 or less per item. Other similar changes were made and still others will be considered during the coming year for adoption wherever simplified procedures can be applied without adversely affecting sound accountability controls over property. Continuing effort for the past several years to improve property accountability controls, and, particularly, utilization and management of the Bureau's movable property, which includes automotive equipment and motor vehicles, is showing definite results in improved field practices.

An inventory of the housing of the Bureau was completed during the year for the purpose of reviewing present rental rates and adherence to established policies for the fixing of proper charges to employees for such housing as has been provided.

The inventory indicated general consistency in rates and compliance with existing Departmental and General Accounting Office policies. This study also showed that 20 percent of all Bureau housing is portable, i. e., can be moved substantially "as is" to meet changing work conditions and requirements. The result of this study will be used during the ensuing year to develop manual coverage of the subject of assignment of quarters to employees and rental rates to be charged employees for quarters where furnished.

Office Services Division

The program for the review and selective screening of records and files and the disposal of records which have lost all administrative, legal, or historical value has continued at an increased pace. During the year, 49 schedules, authorizing Bureau-wide disposal actions on more than 200 types of records, were issued by the Bureau.

A program for the protection of indispensable operating records of the Bureau in the event of a major disaster has been established and is now in operation.

Numerous revisions of the several chapters of the Bureau Manual devoted to records management operations were accomplished to keep pace with constantly changing operating requirements and improved operating procedures.

REGIONAL REPORTS

Region 1

General investigations.—The planning program for the region included work on 5 reconnaissance investigations, 4 basin surveys, 30 project investigations, 10 studies of existing projects, 7 investigations classed as general engineering and research, and 2 advance planning studies.

Final project investigation reports were completed on the domestic water system, north unit, Deschutes project, Oregon, and the Kalispell project, Montana. A special reconnaissance report was completed on the bypass channel, Deschutes project. Reconnaissance reports on the Hartline project, Washington, and on Lewis, Cowlitz, and Chehalis River Basins in Washington were submitted to the Commissioner.

Preliminary project investigation reports were completed on Goose Lake project, Oregon, Fayette Heights unit, Fayette Division, Boise project, Idaho, Sequim project, Washington; Post Reservoir, Crooked River project, Oregon, and Supplemental Storage, Yakima project, Washington. Special reports were completed on the McNary Gravity project, Oregon-Washington; Scriver Creek power facilities, Idaho; and Hells Canyon project, Idaho-Oregon. A definite plan report on Hungry Horse project, Montana, was submitted to the Commissioner for approval.

Bureau planning representatives helped establish a permanent Water Management Subcommittee of the Columbia Basin Inter-Agency Committee, designed to develop a plan under which the river can be operated cooperatively for the purposes of irrigation, flood control, power production, etc. Frank A. Banks, retired district manager, Columbia River District, was named chairman.

A report on Snake River stream flow depletion was completed by the Technical Subcommittee on Operation Plan, CBIAC, consisting of three Bureau of Reclamation employees, and representatives of Bonneville Power Administration and the Geological Survey. The report indicates the depletions to be anticipated in the flow of the river when all foreseeable irrigation development is undertaken.

Construction.—The Columbia Basin project at the year's end was more than half complete. The total investment in the Eastern Washington development was slightly under $400,000,000, with an estimated $320,000,000 of work yet to be done. Outstanding accomplishment of the year in region I was the starting of the world's largest pump at the Grand Coulee Dam for irrigation of Columbia Basin lands and world's record power generation of more than 12½ billion kilowatt-hours.

Continuing the trend established last year, major construction attention centered on the irrigation works of the multipurpose project. Virtually all of the large canals were completed with work progressing increasingly on canals of smaller size and to lateral systems. Major structures completed in addition to the power and pumping plants include the Soap Lake Siphon, approximately 50 miles of main irrigation canal, lateral system for block 71 and most of the systems for block 70, 72, 40, and 21, and the North Dam. A district headquarters building was also completed. From works completed at the end of the fiscal year, it is obvious that construction for the irrigation of 87,000 acres in 1952, as proposed, will be completed on schedule.

Construction on the Hungry Horse Dam in northwestern Montana, the largest dam now being built by the Bureau of Reclamation, progressed at record-breaking speed. All major phases of construction on the important multipurpose project were on or ahead of schedule. Progress on the prime contract was exceptionally good with 1,262,486 cubic yards of concrete placed during the fiscal year to bring total concrete in place in the dam, power plant, and appurtenant works to 1,562,486 cubic yards, or more than half of the estimated 3,100,000 cubic yards required. Average height of the huge concrete arch-gravity dam at the end of the fiscal year was 291 feet, an increase of 172 feet during the year. When it is completed Hungry Horse Dam will be 564 feet high, ranking third among the world's highest concrete dams, being exceeded only by Hoover (762 feet) and Shasta (602 feet).

A $1,796,542 contract covering completion of the 285,000-kilowatt powerhouse and construction of a high-voltage switchyard was awarded and at the fiscal year's end work was progressing on schedule with installation under way on three of the four 105,000-horsepower turbines. All phases of construction are being geared to the generator installation schedule which calls for the first two 71,250-kilowatt units to go on the line in October and December of 1952, with units three and four following in August and November 1953.

Logging, clearing, and road relocation work in the 34-mile long Hungry Horse Reservoir area also progressed well in advance of the rate required by the water-storage schedule. Removal of approximately 90,000,000 board feet of merchantable timber from the reservoir area was virtually completed and clearing contracts were 70 to 87 percent complete.

Relocation work on the 30-mile section of the east side Forest Service road was practically complete, and work was getting under way on two contracts awarded on June 1, 1951, covering construction of a 47-mile long Forest Service road on the west side of the reservoir.

As of the close of the fiscal year the project was 54 percent complete on the basis of total costs to June 30, 1951, as compared with the total estimated cost of $108,800,000.

At Anderson Ranch Dam on the Boise project, work on the spillway, outlet works, and powerhouse was completed and the first of two 13,500-kilowatt generating units was placed into service December 16, 1950. The second unit is scheduled to go on the line in July 1952. On the Payette Division, Boise project, work in the irrigation area consisted largely of drain ditch excavation and improvements to the

Black Canyon Canal to increase the carrying capacity. In the Cascade Reservoir area, work on the relocation of county roads was completed. Work on the last section of the relocated State highway, with the State as contracting authority, continued, with completion expected during the first half of fiscal year 1952. A contract for clearing the remainder of the reservoir was awarded, with completion scheduled for the fall of 1952.

Activity on the Deschutes project was limited to minor contracts for construction of a wasteway, canal sealing and additional checks in the Main Canal, cattle guards and a toe drain at Wickiup Dam. Repairs to the Arnold Diversion Dam were also completed, which completes all work contemplated for the Arnold irrigation district.

On the Lewiston orchards project the water treatment plant and Clearwater Reservoir were completed and placed into service. This completes major construction activity on this project.

On the North Side Pumping Division, Minidoka project, work to explore the feasibility of irrigation by pumping from underground water supplies continued. Total progress to date includes 11 irrigation wells, complete with pumping and lateral systems. Four observation wells were drilled and drilling of six more such wells was in progress at the year's end.

The Palisades-Goshen transmission line on the Palisades project was completed. Work on the first 2½ miles of relocated highway, for which the State of Idaho is contracting authority, continued.

Under the rehabilitation and betterment program, work was completed on the rehabilitation of Tieton Dam and Spillway, Yakima project, and the Bully Creek Siphon of the Vale project. On the Bitterroot project a rehabilitation program, consisting of minor repairs to canals and conduits, continued.

Operation and maintenance.—Crops valued at $184,056,530 were produced in 1950 on 1,999,714 acres under cultivation on 17 projects in region I—an average of $92.04 per acre. The total gross was $11,000,000 more than that of 1949 and the per-acre return was $3.26 greater than that of the preceding year. The highest gross and per-acre returns on record for the northwest projects were set in 1946 at $225,235,236 and $120.18, respectively.

As in previous postwar years, the Bureau made irrigable land available in the Pacific Northwest. Three sales of Government-acquired and public land were conducted on the Columbia Basin project. Seventy-eight applications were made for 56 part-time farm units, comprising 118 irrigable acres on the Burbank pumping unit near Pasco. Early in 1951 some 801 World War II veterans made application for 30 full-time farm units, comprising 2,505 irrigable acres near Moses Lake, and on June 16, 739 World War II veterans participated in a drawing for 20 full-time farm units, comprising 1,635 irrigable acres near Soap Lake and Ephrata, Wash.

Expansion of irrigation occurred on the Roza Division of the Yakima project, where water was made available for 25,000 additional acres, 13,000 of which actually used it, and on the pumping unit of the Payette division, Boise project, where 6,093 new acres received water for the first time. Land adjacent to 11 large wells on the north side pumping division of the Minidoka project, comprising 5,100 acres, is under agricultural lease.

A fourth "development" farm on the Columbia Basin was ready for full operation early in the spring of 1951 and leased. The farms are important units in the cooperative research program in which the Department of Agriculture's Bureau of Plant Industry and the Soil Conservation Service and the Washington State Experiment Station are cooperating with the Bureau of Reclamation. In line with the Bureau's policy of cooperation with Land Grant Colleges and Universities, cooperative settler assistance programs in Idaho, Oregon, Washington, and Montana were continued. Cooperative research programs are in operation with State Experiment Stations in Idaho, Oregon, and Washington and with various agencies of the Department of Agriculture.

Amendatory contract negotiations were continued with 13 irrigation districts, and financial adjustment investigations were in progress for 7 other irrigation districts.

Power production.—Grand Coulee's huge battery of generators were responsible for a new record generation of 13,022,414,997 kilowatt-hours of hydroelectric energy by six Bureau hydroelectric plants in the region.

With the installation of four main units (R–5, R–6, R–7, R–8) and one station-service unit (LS–3) during the fiscal year, Grand Coulee power plant increased its nameplate capacity to 1,866,000 kilowatts. A record peak load of 2,023,000 kilowatts was carried in June and generation for the year hit a record of 12,779,950,200 kilowatt-hours. A monthly record of 1,188,470,200 kilowatt-hours was established in February.

Generation from the region's newest hydroelectric plant began in December with the operation of the first of two 13,500-kilowatt units at the Anderson ranch plant in Idaho. Production from this plant together with that from the 8,000-kilowatt Black Canyon and 1,500-kilowatt Boise River plants enabled the Boise project to earn $156,621.60 in gross revenues from a generation of 105,454,042 kilowatt-hours.

The 13,400-kilowatt Minidoka power plant produced 111,508,840 kilowatt-hours to earn gross revenues of $463,181.96, and the 2,400-

kilowatt Prosser plant on the Yakima project produced 25,501,915 kilowatt-hours to earn $62,447.47.

The total production of the Grand Coulee plant since March 22, 1941, is 63,365,233,000 kilowatt-hours. Forty-five percent of the power supply from Grand Coulee and Bonneville Dams was used by the aluminum industry which in calendar year 1950 produced 48 percent of the aluminum output of the United States.

Region 2

General investigations.—The most significant development in its impact on water resource development in California and southern Oregon was the shift in current national objectives and the consequent elimination of new planning starts.

An interim report, essentially a compendium, was prepared for the Trinity River, evaluating the utilization of the Trinity for defense power purposes.

A feasibility report was completed for the Sacramento River Canals, Central Valley Basin plan, California, pursuant to H. R. 163, Eighty-first Congress, first session, which authorized the canals as an addition to the Central Valley project.

The proposed Regional Director's report on the North Fork Kings River unit, Kings River Division, was completed. This report supplements information contained in a previous report on the North Fork Kings River development (H. D. 537, 81st Cong., 2d sess.).

Substantial progress was achieved upon Trinity River, San Luis, Klamath Basin, Pajaro River and Union Valley investigations and advance planning work on the authorized Solano project.

Construction.—Central Valley project construction on Shasta Dam and power plant, Keswick Dam and power plant, Friant Dam, Madera Canal and Contra Costa Canal is practically completed and these features are in full operation. Tracy pumping plant is substantially completed and three of the six pumps including 22,500-horsepower motors were to be in full operation August 1, 1951. The remaining three pumps and Tracy Switchyard are 95 percent completed. Energy for pumping unit testing was supplied over the newly energized east side 230-kilovolt Shasta-Tracy transmission line.

Delta-Mendota Canal, 117 miles in length, is in final stages of construction. The upper reach of the canal has been operated to dispose of water pumped during test periods. Full operation of the canal to Mendota pool was contemplated by August 1, 1951. Friant-Kern Canal, 153 miles in length, is completed and in operation to Poso Creek. The Delta Cross Channel is essentially completed and was to be placed in operation August 1, 1951.

Distribution system construction is under way by contract for the Southern San Joaquin Municipal Utility District, including three units, of which one is completed and in operation, the Lindsay-Strathmore irrigation district, and the Lindmore District. Plans and specifications are under preparation for Exeter, Stone Corral, Ivanhoe, Delano, Earlimart, and Saucelito irrigation districts. The Madera irrigation distribution contract has been executed and construction scheduled for fiscal year 1953.

Contracts were awarded for Folsom power plant turbines and generators, earthwork for the powerhouse, warehouse, penstock fabricating areas, tailrace channel and tailrace channel access roads. The Corps of Engineers is receiving bids on the main structure of Folsom Dam, August 31, 1951.

Cachuma project construction under contract consists of Tecolote tunnel 50 percent excavated, Cachuma Dam 20 percent completed, Lauro Dam 5 percent completed, South Coast conduit (Goleta section) 75 percent completed.

Klamath project work completed during the year consisted of Lost River Channel improvements, Lower Langell Valley; Lost River Diversion Channel enlargement, improvements to pumping plants G, H, J, K, L and M; enlargement of feeder drains to pumping plant A; structures and seepage control 1946–48 homestead area. Work presently under construction consists of structures for pumping plants 1, 2, 3, 4, and 5, strengthening of main dikes, Tule Lake sump; and Lower Lost River Channel improvements. Specifications and plans were under preparation for starting construction of laterals and drains for the "N" Canal area, Tule Lake sump; and Lost River Channel improvements, Upper Langell Valley.

Power.—All the generating units at both Shasta and Keswick power plants were in operation during the year, resulting in energy sales totaling 2,206,008,200 kilowatt-hours and power revenues of over $10,500,000. This is an increase in revenue over fiscal year 1950, the highest previous record, of almost 13 percent. As previously, about 99 percent of CVP power was sold to the Pacific Gas & Electric Co. under terms of a day-to-day agreement in effect since January 1, 1949. Negotiations toward a sales contract to replace the day-to-day agreement were not concluded during the year. Contract I75r–2650 was executed with the Pacific Gas & Electric Co. on April 2, 1951, for transmission and exchange service. It provides that the company will transmit CVP power over its system to project customers. The first CVP power sales contract with a preference customer, providing for delivery over the facilities of the Pacific Gas & Electric, was executed by the Westside irrigation district on June 8, 1951.

Studies were accelerated in the interest of national defense on the feasibility of supplying CVP power to the Riverbank Aluminum Plant and the Ames Laboratory of the National Advisory Committee for Aeronautics at Sunnyvale, and on an interconnection between the Central Valley project and the Bonneville Power Administration.

Operation and maintenance.—All completed features of Central Valley project and completed portions of features still under construction were operated during fiscal year 1951 under the direction of the newly created CVP Operations Office.

Water supply contracts were executed with the Exeter, Saucelito, Stone Corral, Madera, Lindsay-Strathmore, Lower Tule River, Terra Bella, and Tulare irrigation districts and the Chowchilla Water District.

Six temporary contracts for water service along the San Joaquin River were handled during the year. Proposed contracts with the Delano-Earlimart and Porterville irrigation districts and the Contra Costa County Water District were approved as to form by the Secretary.

Land classification and land use studies were completed on approximately 600,000 acres. This work consisted of agricultural studies and crop mapping for the purpose of determining beneficial use of water rights investigations. Land use studies leading to determination of water requirements for water sales contracts were conducted for eight irrigation districts. Land studies for preliminary investigations and definite plan reports were conducted on the service area of the American River, Sacramento Valley Canals, Black Butte Reservoir and in the Klamath Basin.

The administration of the excess-land provisions of Reclamation law was given active attention. Five recordable contracts providing for delivery of CVP water to 3,570 acres of excess land are the first to be executed on the project. In addition, several sales of large tracts prior to project water deliveries resulted in a net decrease in excess land.

Region 3

General investigations.—Potential project investigations in region 3 were expedited. Following installation of a cableway at mile 32.8 on the Colorado River in Marble Canyon, the Bureau's field forces diamond-drilled and made geologic investigations of the potential dam site there. Investigations at this site being completed, the cableway was dismantled and moved downstream to mile 39.5 dam site for similar field studies.

Storm studies needed for future designs for dams and power plants included in the potential Central Arizona project were made; the potential second barrel of the San Diego aqueduct was further studied; all field investigations on the Moapa Valley project, Nevada, and the Santa Margarita project, California, were completed.

The Bureau established a project planning field office at Kingman, Ariz., in August 1950 from which investigations were started on the Fort Mohave project, Nevada. Studies of the Victor project, California, were resumed.

Construction.—Construction by the Utah Construction Co., under the prime contract for the Davis Dam embankment, intake, spillway, and powerhouse structures was completed in December 1950. The utility building and parking area, architectural finish in the powerhouse, and the stilling basin are yet to be completed. The Bureau's 1,500-mile transmission system in this region was placed in limited operation.

Installation of two generating units, A–3 and A–4 for the State of Arizona, and the Nevada unit A–9 in the Arizona wing of the Hoover power plant was started. These units, scheduled to be in operation early in 1952, will bring the Hoover power plant's capacity to 1,249,800 kilovolt-amperes. Nevada's Hoover and Davis energy was initially supplied the State through the basic magnesium plant substation on June 1, 1951.

The Colorado River was diverted into the new man-made 12-mile channel through the swamp between Needles, Calif., and Topock, Ariz., on June 25, 1951. The channel was cut by the Bureau's dredge, The Colorado, to reduce the river surface elevation in the swamp and thus lessen the flood danger to Needles and also reduce water losses out of the river from evaporation and transpiration.

The 18½-mile Wellton-Mohawk Canal on the 75,000-acre Wellton-Mohawk division of the Gila project was substantially completed. The canal system will carry its first Colorado River irrigation water next year.

Unit 7 of the Coachella Valley underground distribution system is substantially completed, and work is in progress under two contracts on part 1 of unit 9. All work under the $13,500,000 distribution system repayment contract will be completed in the fall of 1951. The Coachella Main Canal, completed in 1948. eventually will deliver Colorado River water through the lateral system to some 78,500 acres of land in the Coachella Valley. Laterals were completed to serve 28,000 acres in 1950, and it is estimated that by the end of 1951 construction will have progressed sufficiently to enable 60,600 acres to receive water.

Operation and maintenance.—Region 3 projects in 1950 produced crops valued at $146,000,000 on 879,000 acres. This, the third highest income on record, was exceeded only by $171,000,000 in 1948 and $152,000,000 in 1949.

Arrangements were made for transfer on July 1, 1951, of the operation and maintenance of the valley division, Yuma project, to the

Yuma County Water Users' Association. The valley division has been perated by the Bureau since water was first available in 1912. The Bureau will continue to operate the project's Reservation division and he common facilities serving the valley division.

The Mexican Water Treaty of 1944 became effective on November , 1950, and since then all water diversions from the Colorado River bove the lower international boundary for use in Mexico have been made at Morelos Dam, completed by Mexico in 1950. Deliveries of water from the All-American Canal for use in Mexico, via Pilot Knob wasteway, were discontinued on November 7, 1950, and at the lose of the fiscal year had not been resumed.

A contract for construction of the Yuma levee earthwork and structures was awarded to Gibbons & Reed Co., Salt Lake City, Utah, on May 21, 1951. The levee system will protect areas adjacent to the iver in this country and in Mexico from possible floods.

Rehabilitation and betterment work on the Salt River project onsisted of lining 2 miles of main canal and 9 miles of laterals with oncrete, replacing certain canals and laterals with pipe conduits, epairing or replacing gates, checks, and other minor irrigation tructures, and rehabilitating project water wells. This work is being performed by the Salt River Valley Water Users' Association under he general supervision of the Bureau of Reclamation and with funds made available under a repayment contract with the United States.

Power.—Hydroelectric plants on the Colorado River—producing over 5 billion kilowatt-hours of energy during fiscal year 1951—coninued to make this region the powerhouse of the Southwest.

The Bureau's fourth largest hydroelectric plant at Davis Dam reached full production June 16, 1951, when unit No. 5 went on the line. Secretary Chapman pressed a key in Washington January 5, 1951, to signal the start of the first of the plant's five 45,000-kilowatt units. Davis generators will add approximately a billion kilowatt-hours of energy annually to that generated on the lower Colorado River.

All water released from Hoover and Parker Dams and, since April 16, 1951, from Davis Dam, was utilized for power production. Releases of water from Davis and Parker Dams were held to the minimum necessary to satisfy downstream requirements. All additional water released from Hoover Dam was stored in Lake Mohave to fill that reservoir by May 29, 1951, with 1,696,300 acre-feet of usable storage. At the end of the fiscal year, the reservoir above Davis Dam extended upriver 67 miles to the Hoover power plant tailrace.

Region 4

General investigations.—A report on the Colorado River storage project and participating projects was completed during fiscal year

1951. It outlined a plan calling for 10 major developments for river regulation, power production, and other benefits from additional controls on the Colorado River. The plan, which is based on the use of power revenues to assist in paying costs of sound irrigation projects (participating projects) utilizing Upper Colorado River Basin water, was reviewed and favorably commented upon by the five Upper Colorado River Basin States. The governors of these States also concurred in the Commissioner of Reclamation's recommendation that the storage project and initial group of 11 participating projects be authorized. Supplemental reports on the participating projects were also reviewed by the Basin States and Federal agencies concerned. As the fiscal year ended, the reports, together with the comments of the States and Federal agencies were being readied for submission to the Bureau of the Budget and the Congress.

Region 4 planning engineers also prepared reconnaissance reports on the Gunnison River and Washoe projects, in addition to a report recommending addition of a power plant to the nearly completed Provo River project, Utah. As the result of nearly 2 years of detailed investigations, they looked forward to completion of a definite plan report on the $70,000,000 Weber Basin project early in fiscal year 1952. This project was authorized in August 1949. Substantial progress was made on investigations of the Gooseberry, Animas-LaPlata, South San Juan, Fruitgrowers Dam project extension, Bear River, Savery-Pothook (unit), and Sublette projects. Policy problems delayed completion of additional volumes of the definite plan report on the Eden project, Wyoming.

Construction.—Eighty-three percent of region 4's construction goal was accomplished during fiscal year 1951. This was approximately $6,173,000 of a $7,444,000 program.

The Salt Lake aqueduct was brought to completion during the year, and work was sufficiently advanced on the 40,000,000-gallon terminal reservoir to insure its completion by the middle of fiscal year 1952, reinforcement steel priorities permitting. Excavation of the 6-mile Duchesne tunnel, a companion feature of the Provo River project, was pushed to within 1.4 miles of completion. Fiscal year 1952 schedules call for holing through of the tunnel and construction of the diversion dam, which will divert water from the Duchesne River drainage to the Upper Provo River. Completion of the entire job, including concrete lining of the tunnel, is scheduled for February 1953.

Accelerated construction activities on the Eden project, Wyoming, gave assurance that Big Sandy Dam, the key feature, would be completed by the middle of fiscal year 1952. Work on the distribution system was scheduled to start during the second quarter of fiscal year 1952, commencing with construction of the Means Canal.

Construction crews on the Fire Mountain Canal, Paonia project, Colorado, had practically completed the work of enlargement by April 16, 1951, when the new canal was placed in operation. Further work on this project, including construction of a storage dam on a tributary of the North Fork of the Gunnison River, was dependent upon Congressional reauthorization.

Rehabilitation and betterment program progress on the Grand Valley project in Colorado, included the concrete lining of tunnel No. 3 (completing emergency repairs started in 1950) and completion of six major concrete flumes on the Highline Canal. Three siphons, also a part of the Highline Canal, were scheduled for construction during fiscal year 1952.

Operation and maintenance.—Dependable late-season water supplies, bolstered by 16 Bureau-constructed storage reservoirs and Lake Tahoe, enabled farmers on 18 projects to mature crops having a gross value of $32,067,336 during the calendar year 1950. This was an average of $58.79 per cropped acre from 545,485 acres cultivated.

The Grand Valley Water Users Association executed an amendatory contract on May 5, 1951, increasing its repayment obligations from $1,500,000 to $1,900,000. This enabled continuation of an extensive rehabilitation and betterment program for the Garfield Gravity Division of the Grand Valley project, Colorado.

The Commission notified the Preston, Riverdale & Mink Creek Canal Co. that the deferment period on construction charges for the Preston Bench project, Idaho, would begin January 1, 1950, and that the company was to assume operation and maintenance of the project works on June 30, 1950.

On May 1, 1951, the Metropolitan Water District of Salt Lake City assumed operation and maintenance of the completed portion of the Aqueduct Division, Provo River project, Utah, consisting of the Salt Lake aqueduct, extending 42 miles from Deer Creek Dam to, but not including, the Terminal Reservoir on the outskirts of Salt Lake City. On July 1, 1951, the district made a $200,000 initial payment to apply on aqueduct construction costs.

On August 5, 1950, the Congress approved amendatory repayment contracts with the Ogden River Water Users Association for the Ogden River project, Utah, and with the South Cache Water Users Association for the Hyrum project, Utah.

The region continued joint studies and investigations under the lower cost canal lining program under cooperative agreements with the Soil Conservation Service and the Utah Agricultural College Experiment Station.

New soil and moisture conservation measures were initiated on the Moon Lake, Humboldt, and Newlands projects.

Power utilization.—Investigations and studies were advanced on six projects involving 1,748,800 kilowatts of installed hydroelectric generating capacity distributed as follows: Weber Basin, 5,400 kilowatts; Collbran, 7,400 kilowatts; Provo River (Deer Creek power plant), 7,000 kilowatts; Colorado River Storage, 1,622,000 kilowatts; Central Utah (initial phase), 61,000 kilowatts; and Washoe, 46,000 kilowatts. The fiscal year 1952 planned workload included continuation of these studies, in addition to reconnaissance type investigations on the Cliffs-Divide project in northwestern Colorado, Sublette project in southwestern Wyoming, South San Juan project in northwestern New Mexico, and the San Miguel and Animas-LaPlata projects in southwestern Colorado; also status report on preliminary work being conducted on the Bear River project, Utah.

Region 5

General investigations.—A report on New Mexico's water resources was sent to the New Mexico Economic Development Commission and the Commissioner. Reports on the Lower Nueces River project, Texas, and the Canton project, Oklahoma, were forwarded to the Commissioner. Preliminary drafts of reports on the Washita River subbasin, Oklahoma, and the Carlsbad project, New Mexico, were distributed to Federal and State agencies and the Commissioner. Funds were requested for constructing an auxiliary spillway at Alamogordo Dam. Hearings were completed on Fort Gibson project, Oklahoma. An unfavorable report on construction of this project by the Federal Government is in progress. West Texas and Balmorhea project reports continued. San Juan-Chama project investigations consisted primarily of studies of potential uses of San Juan water in the Rio Grande Basin. Arkansas-Red River Basin investigations were combined after establishment of an Arkansas-White-Red Basins Inter-Agency Committee. Middle Rio Grande project advance planning was initiated. Vermejo project, New Mexico, and Canadian River project, Texas, were authorized. Objectives for fiscal year 1952 include program reports on reconnaissance findings for Gulf Basin and San Juan-Chama project; reports on Balmorhea project and Brownwood Division, West Texas project; establishment of a definite investigation program for Pecos River Basin; continuation of the Arkansas-White-Red Basins survey; definite plans for Middle Rio Grande project channel construction between Elephant Butte Reservoir and lower boundary of the Conservancy District and drainage rehabilitation; definite plans for the Vermejo project; and initiation of Canadian River project advance planning.

Construction.—Construction was completed on the following: Fort Sumner project, New Mexico; repairs on Pecos River flume, Carlsbad project; exploratory drilling on San Luis Valley project; gate-tender's house, Platoro Dam; additional capacity and pressure for water system Government camp at Elephant Butte Dam; road improvements and seven additional housing units for employees at Elephant Butte and Caballo Dams; Hollywood Substation; Hot Springs Tap Line and Substation; Lucero Arroyo Protective Works; four ditch-rider residences and garages, Tucumcari project, New Mexico; Drain F, earthwork and structures, and Altus Canal wasteway, W. C. Austin project, Okla. Construction of Platoro Dam and clearing of Platoro Reservoir site, San Luis Valley project, Colorado, was continued. Construction was initiated on the Socorro-Albuquerque transmission ine, Albuquerque Substation, Belen-Willard transmission line, and Belen and Willard Substations, Rio Grande project. Fiscal year 1952 will see the completion of the Platoro Dam. Fort Sumner project will be turned over to the water users for operation and maintenance. All transmission facilities and substations on the Rio Grande project will be completed in fiscal year 1952. Channelization of the Rio Grande River above Elephant Butte Reservoir will be nitiated as part of Middle Rio Grande project work.

Operation and maintenance.—Operation and maintenance work involves five projects in full operation, four operated by the Bureau and one by water users; one water conservation and utilization project; one Warren Act contractor; two projects under construction. On the ive operating projects, 262,166 acres in 9,799 farms, with a population of 49,094, were irrigated in 1950. Total gross crop income was $53,725,167.

On the Rio Grande project, 158,704 acres of irrigated land grew crops valued at $44,782,276, or $281.34 per acre. The 17,318 acres irrigated with water delivered under a Warren Act contract on the Hudspeth project produced crops valued at $5,067,977, or $292.64 per acre. The Carlsbad project's irrigated 19,007 acres grew crops valued at $3,281,407, or $172.65 per acre. W. C. Austin project facilities were completed for the 47,809.4 irrigable acres. The irrigated 45,953.7 acres grew crops valued at $3,460,601, or $73.86 per acre. Tucumcari project facilities were completed for 42,321 irrigable acres. The irrigated 31,563 acres grew crops valued at $1,110,368, or $35.18 per acre. On the Balmorhea project, the irrigated 6,938 acres produced crops valued at $1,090,452, or $154.17 per acre. On the Fort Sumner project, the irrigated 4,915 acres grew crops valued at $310,590, or $68.98 per acre. This project continued under construction. Platoro Reservoir, San Luis Valley project, was under construction. The irrigated 71,884 acres grew crops valued at $2,560,429, an average of $35.60 per acre.

The Soil and Moisture Conservation program includes building dikes and facilities on Lucero Arroyo, Rio Grande project, and diversion terraces in the Alamogordo Reservoir area. Salt cedar spraying continued in the McMillan Reservoir area.

Power production.—Total energy sold in fiscal year 1951 from the Rio Grande project's hydrogenerating plant at Elephant Butte Dam, N. Mex., was 64,395,913 kilowatt-hours, producing revenue of $407,420.64. Low water in Elephant Butte Reservoir resulted in below normal generation. Proposed early additions to the project's power system are 79 miles, 115-kilovolt transmission line from Socorro to Albuquerque, with a substation at Albuquerque, and a 50-mile, 115-kilovolt tap transmission line from near Belen, N. Mex., to Willard, N. Mex., with a substation at Willard. Facilities for the Albuquerque extension will be completed in fiscal year 1951, and for the Willard extension in fiscal year 1952. Current contracts with private utilities provide for power and energy for firming Elephant Butte generations during low water conditions on the Rio Grande, and for movement of power over Bureau lines from points having reserve capacity to points in New Mexico having critical needs for power.

Region 6

General investigations.—Investigations to obtain material for basin reports were carried forward on 32 divisions. No division reports were submitted in fiscal year 1951, but the report for Cannonball division is scheduled for completion in fiscal year 1952. In addition, a reconnaissance report for Little Missouri division is scheduled for completion in fiscal year 1952. Four definite plan reports were processed during the fiscal year. The report for Angostura unit was approved by the Commissioner; the report for Crow Creek pump unit was reviewed by the Commissioner, but requires additional studies; the report for Hanover unit was submitted to the Commissioner late in the fiscal year; and the report for Bixby unit indicated a poor quality of water, resulting in postponement of all activities on this unit. Approximately 18 definite plan reports are scheduled for submission to the Commissioner in fiscal year 1952.

Construction.—One hundred thirty-two specifications for construction work and major equipment were issued in fiscal year 1951, with contracts amounting to over 30 million dollars being awarded.

The following construction was completed by contract during the fiscal year: Dickinson Dam, Dickinson unit; relocation of C. B. & Q. Railroad and most of clearing on reservoir area, Boysen unit; considerable canal lining and several bridges, Riverton project; substantially all of Shadehill Dam, relocation of cemetery and clearing portion of reservoir area, Shadehill unit; clearing portion of reservoir area, Keyhole unit; canal and wasteway structures, Buffalo Rapids project; access road to dam, Angostura unit; relocation of cemetery and temporary housing, Canyon Ferry unit; housing at Chester, Mont., and most of Tiber government camp, Lower Marias unit; Rudyard, Circle, Wolf Point, Miles City and Savage substations, warehouse for Havre substation and Havre-Shelby transmission line, Fort Peck project; Fresno Dam parapet wall, Milk River project; Edgeley-Forman, Jamestown-Edgeley, Leeds-Rolla, Voltaire-Rugby-Devils Lake-Carrington, Devils Lake-Lakota and Boysen-Thermopolis transmission lines and Beulah, Watford City and Williston substations, transmission division.

Construction progress during the fiscal year and to date on major contracts carried over from fiscal year 1950 and continuing into future fiscal years follows: Keyhole Dam, 47 percent completed during the year with 47 percent of the total contract completed by June 30; Boysen Dam and Power Plant, 75 and 91 percent and Canyon Ferry Dam and Power Plant, 21 and 42 percent.

New construction contracts awarded during the fiscal year follow: Improve access road to dam, canals, laterals, and drains and power plant, Angostura unit; clearing reservoir area, Boysen unit; clearing portion of reservoir area and warehouse, Canyon Ferry unit; county bridge reconstruction and road relocation, Dickinson unit; fencing of wildlife habitat area, Heart Butte unit; relocation of county road and U. S. Highway No. 14 and clearing portion of reservoir area, Keyhole unit; the Lovell, Sioux Falls, Watertown, Huron, Mount Vernon, Washburn, Bismarck, Jamestown, Rugby, Devils Lake, Lakota, Leeds, Bisbee, Rolla, Carrington, Edgeley, Valley City, and Forman substations, Transmission Division; the Garland-Lovell, Thermopolis-Lovell, Garrison-Fort Peck Tie, Canyon Ferry-East Helena, Garrison-Voltaire, Devils Lake-Lakota, Jamestown-Valley City, Bismarck-DeVaul, Sioux Falls-Brookings, Brookings-Watertown-Groton-Huron, Huron-Armour, Gavins Point-Sioux Falls, Fort Randall-Gregory-Winner, Armour-Fort Randall-Gavins Point, Rapid City-Wall-Midland, Oahe-Mobridge, Fort Randall-Oahe, and Bismarck-Mobridge, transmission lines, Transmission Division; the Glendive-Williston transmission line and Rudyard and Shelby substations, Fort Peck project; canal and wasteway structures, Buffalo Rapids project; C. J. Coulee Siphon, Shoshone project; lining portion of Vandalia Canal, Milk River project; and considerable canal lining, permanent O&M camp, bridges for Five Mile and Muddy Creeks, Wyoming Canal from station 2560 to end, and the development farm buildings, Riverton project.

In fiscal year 1952, construction work is scheduled to start on the irrigation facilities for Fort Clark, Heart Butte and Cartwright units. Major construction scheduled for completion is Boysen Dam. Angostura Power Plant, remainder of Wyoming Canal on Riverton project, Keyhole Dam, a number of transmission lines and substations, and a portion of the irrigation system on Angostura unit. It is estimated that 7,500 kilowatts of power from Boysen and 1,200 kilowatts from Angostura plus 6,750 acres of irrigated land on Riverton and 4,000 acres on Angostura will be made available by the close of the fiscal year. The remaining power from Boysen and the additional acreage on Angostura are scheduled to become available in fiscal year 1953.

Operation and maintenance.—The 12 operating projects in region 6, receiving a full water supply from Bureau works, produced crops in 1950 worth $18,006,620 from a net area under cultivation of 408,513 acres. The Bureau delivered supplemental water to an additional 8,406 acres from which the gross crop value was $202,166. During the fiscal year, 47 farm units, comprising 6,016 acres of irrigable land, were awarded to veteran settlers under the provisions of Public Notice No. 30, Riverton project.

The Angostura Irrigation District and the Buford-Trenton Irrigation Districts were organized and steps were taken to organize an irrigation district for the Crow Creek Pump unit.

An amendatory repayment contract with Midvale Irrigation District was executed on behalf of the United States. An amendatory contract was executed by the Malta Irrigation District, and one is in the process of execution by the Glasgow Irrigation District, both of the Milk River project. Amendatory repayment contracts with Lower Yellowstone Irrigation Districts Nos. 1 and 2 were approved as to form by the Secretary.

A new contract was executed with the Angostura Irrigation District. In addition, three additional new contracts with the Buffalo Rapids Irrigation Districts, Nos. 1 and 2, and Fort Clark Irrigation District were approved as to form by the Secretary. Also, a proposed water-service contract with the Belle Fourche Irrigation District for supplemental water from Keyhole unit was approved by the Secretary and the irrigation district board. Arrangements were made for furnishing water on a rental basis to individual farmers on the Heart Butte and Dickinson units who are anxious to initiate irrigation development without waiting for construction of the entire unit.

A rehabilitation and betterment contract, authorized by Public Law 335, Eighty-first Congress, first session, was executed with the Fort Shaw Division of the Sun River project for the expenditure of funds in fiscal years 1951 and 1952.

The completed portion of the Riverton project was transferred to the Midvale Irrigation District January 1, 1951.

The Bowbells, Mandan, Redfield, and Huron Development Farms were in operation during the entire fiscal year, with operation on the

Riverton Development Farm getting started late in the fiscal year. Plans were completed for the Shadehill Development Farm.

Power utilization.—During the fiscal year, 16 contracts involving ale of power to REA Cooperatives, irrigation districts, utilities, and ndustries within the region were completed. The number of cooperaives in the region served with Federal power increased from 34 to 37. Total power revenues for fiscal year 1951 were $1,550,736 as compared o $1,524,808 for fiscal year 1950. Generation of Federal hydroelectric power plants in region 6, for which the Bureau markets the power, was 430 million kilowatt-hours in fiscal year 1951. It was recommended to the Army Corps of Engineers that a second power plant of 80,000 kilowatts be constructed at Fort Peck project.

Region 7

General investigations.—At the year's end, the investigations program accomplishments were encouraging. The Gunnison-Arkansas Initial Development Report had been completed and forwarded to the Commissioner and all other interested agencies, as had the MRB Power Survey Report and the Glendo Unit Definite Plan Report. The inishing touches were being put on the Lower Platte River Basin Report, and the Sargent, Frenchman-Cambridge, Bostwick and Narrows Definite Plan Reports were well advanced toward completion and will be completed in fiscal year 1952. During the latter part of the year, the regional office reevaluated its progress on investigational activities and has prepared better estimates of the time, manpower, and funds required to carry forward the work in future years.

Construction.—Construction contractors generally were not able to comply with their optimistic estimates of performance. They encountered increasing difficulty in securing materials and equipment, particularly rolled steel shapes, copper or aluminum conductor, and other critical materials. Scarcity of labor was evidenced in some skills. Toward the end of the year, contractors were found to be increasingly reluctant to bid on long-term contracts involving critical materials or large amounts of manpower.

Construction activities were widespread throughout the region. Some 43 major contracts involving $118,700,000 were in force, including 10 major dams, 66 miles of canals, 10 miles of tunnels, 5 power plants, and 808 miles of transmission lines. On the Colorado-Big Thompson project, work was completed on Granby pumping plant, Estes and Marys Lake power plants; work was continued on the Horsetooth feeder canal, Olympus and Pole Hill tunnels, and Carter Lake Dams and pressure tunnel; and during the year, contractors started work on Willow Creek Dam, Rattlesnake & Bald Mountain tunnel, Pole Hill and Flatiron power plants.

This fiscal year saw the completion of Kortes and Bonny Dams, th Superior Courtland diversion dam, and the dedication of the Ceda Bluff Dam.

Canal and lateral work on the MRB project was curtailed pendin resolution of repayment contract problems in the Kansas River Basi Very little canal construction was in progress on the Frenchman Cambridge division. On the Bostwick division construction on onl the Superior Canal and Nebraska sections of the Courtland Canal wa in progress.

Construction of the Narrows and Glendo Dams, originally schedule for a start in the spring of 1949, has been again delayed until fisca year 1953 because of inability to resolve all problems with State an local groups.

All major features for the Colorado-Big Thompson project will b either completed or under contract in fiscal year 1952. In the Bostwic division, the Superior Canal and laterals and the Nebraska section o the Courtland Canal and laterals will be completed and constructio initiated on the Franklin Canal and Franklin south-side pumpin plant, canal and laterals, but progress in Kansas will be slow due t court action and negotiation of repayment contracts. Other construc tion of importance is the continuation of work on Trenton Dam an the Cambridge Canal and laterals in the Frenchman-Cambridge divi sion, and completion of some transmission lines in Wyoming an Nebraska. Work on the St. Francis and Cedar Bluff units will b limited mainly to negotiations of repayment contracts.

Operation and maintenance.—Provision for canal-side delivery o water from existing facilities to 1,600 acres of land in the Bostwic division and 1,900 acres in the Frenchman-Cambridge division ha been approved and some of the lands actually furnished water durin May and June. This acreage, together with 1,800 scheduled acres o the Kendrick project, was all the additional acreages placed unde irrigation during 1951. In fiscal year 1952, completion of the Superio Canal and Nebraska section of the Courtland Canal and laterals i Nebraska (Bostwick division), further sections of the Cambridg Canal (Frenchman-Cambridge division), work on the Casper Cana lining (Kendrick project), and completion of the Poudre and Nort Poudre supply canals (Colorado-Big Thompson) will allow for th irrigation of some 14,500 acres of new land and 206,000 acres to whic only a supplemental supply is furnished.

Power.—In addition to the four hydroplants which have been i operation for the past several years, three other power plants, namely Kortes, Estes, and Marys Lake, were placed in operation. The Korte plant can operate full time, but operation of the other two will b limited until sustained pumping can be maintained from Granby Resrvoir on the western slope. These seven plants have a combined apacity of 150,000 kilowatts, and during fiscal year 1951 generated 58,446,686 kilowatt-hours of electrical energy, which were sold to nunicipalities, REA cooperatives, industrial plants, and public utilties, for a gross revenue of $2,659,666.

laska District

General investigations.—The Canadian and the United States Govrnments jointly continued studies of Yukon-Taiya project, an interational development that would improve navigation on the Yukon River and produce huge amounts of hydroelectric energy by dropping xcess Yukon River water to the sea via a transmountain diversion unnel. Reconnaissance studies were completed during the month of March under the auspices of a special committee set up by the Minister of Resources and Development of the Canadian Government and the Secretary of the Department of the Interior in collaboration with the State Department of the United States Government. Deailed investigation is awaiting clarification of international aspects. The Wood Canyon project, an alternate All-American project embracing essentially the same power markets as Yukon-Taiya project, is under investigation. It has potentialities of over 1,000,000 kilowatts of capacity.

Lake Dorothy project, located near the capital city of Alaska and subject of an interim project report shelved in fiscal year 1950, was reactivated by proposals for essential and strategic industrial developments in the Juneau power market area. Studies were complete at the end of the fiscal year with a project report scheduled for submission to Commissioner of the Bureau of Reclamation during first quarter fiscal year 1952.

Swan Lake project, to serve the power deficient Ketchikan area, was the subject of a project report submitted to the Washington office. Studies revealed potential annual firm power production of 71 million kilowatt-hours and secondary energy of 8.8 million kilowatt-hours. Construction is estimated to cost $10,485,000.

In the Fairbanks area, dynamic growth stemming from migration of people and capital into the Territory, development of natural resources, and a resurgence of military activities resulting from international tensions, taxed the capabilities of power producers. Wickersham project is under investigation to determine feasibility of serving this area. Between Fairbanks and Anchorage in the rail-belt area, potentialities of Susitna River are being investigated. The basin report is scheduled for submission to the Commissioner's office in fiscal year 1952.

Construction.—Alaskan activities were highlighted by congressional authorization of the $20,365,400 Eklutna project on July 31, 1950. This was the first Bureau of Reclamation project authorized for construction in the Territory of Alaska. To be located 34 miles north of the city of Anchorage and 14 miles south of Palmer, it will add 30,000 kilowatts of capacity to the Anchorage-Matanuska Valley power supply. Eklutna Lake, a natural reservoir 862 feet above sea level, lies near an arm of Cook Inlet with only a narrow mountain intervening. Development encompasses diversion of lake water through a transmountain tunnel down a penstock and into a power plant at the base of the mountain near sea level. The 143 million kilowatt-hours of firm energy and 21 million kilowatt-hours of nonfirm energy thus to be made available each year will be transmitted northward to serve Matanuska Valley, the city of Palmer, and several coal mines, and southward to serve Elmendorf Air Force Base, Fort Richardson, the city of Anchorage, and adjacent areas.

Classed as an emergency project, the Congress in September appropriated $1,100,000 for initiating construction. Project work started immediately, a construction office opened at Palmer, and preparation of the definite plan report expedited. Drilling crews continued subsurface geological investigations through the winter despite temperatures of minus 50° and lower. The definite plan report was completed on May 15.

At the close of the fiscal year the percent completion of each project feature under actual construction was as follows: 12 permanent residences, two 10-car garages, streets, and utilities, 10 percent; laboratory building, 60 percent; warehouse building, 8 percent; 115-kilovolt Eklutna-Palmer transmission line, 2 percent; and water-supply well for Government camp, 100 percent. Construction will be initiated during fiscal year 1952 on the 4½-mile-long tunnel and other hydraulic structures, the power plant, electric switchyard, and Eklutna-Anchorage transmission line. Programmed expenditures for next year total $5,761,500. Peak construction activities are scheduled for fiscal year 1953, when contractors are expected to do $10,152,300 of work. All construction should be completed by November 1954.

Division of Water and Power

Reginald C. Price, Director

SECRETARIAL ORDER No. 2601 dated December 1, 1950, established in the Office of the Assistant Secretary for Water and Power Development a Division of Water and Power. The activities of the former Division of Power and the staff functions of the former Water Resources Committee were transferred to the new division. It was also given additional duties in connection with water programs. The principal functions of the new division are to provide technical staff assistance to the Assistant Secretary for Water and Power Development, and to assist in (1) establishing and clarifying departmental policy, (2) coordinating the activities of the various water and power agencies of the Department to bring about consistent actions, and (3) aiding in the formulation of an over-all departmental program. The agencies over which the Assistant Secretary for Water and Power Development exercises secretarial direction and supervision are the Bureau of Reclamation, Bonneville Power Administration, Southeastern Power Administration, and Southwestern Power Administration.

During the 12 months ended June 30, 1951, these agencies marketed 24,764 million kilowatt-hours produced by plants having an installed generator (nameplate) capacity of 4,910,500 kilowatts on June 30, 1951, for which $67,552,000 was received in revenues at an average price of 2.73 mills per kilowatt-hour sold. The attached table shows these data for each power marketing agency.

In marketing this power, the Department continued to carry out the policies of Congress (1) to give preference to public bodies and cooperatives and prevent monopolization, and (2) to sell power at the lowest possible rates which will return the investment plus interest and assure the widest possible use. Where facilities of private utilities are available and where it is in the public interest, the Secretary of the Interior has entered into agreements for the transmission of power from load centers to the Government's customers. Many such agreements have been signed.

Federal agencies for which the Department markets power have under construction approximately 3,850,000 kilowatts generator capacity. Of the 27,000,000 total additional kilowatts of capacity needed to be completed during the 3 years 1951–53 for national security, approximately 2,800,000 kilowatts are scheduled for installation in such Federal projects.

During the year the Department, through the Division of Water and Power, reviewed 26 reports of the Corps of Engineers, Department of the Army, concerned primarily with flood control and navigation; 10 reports of the Department of Agriculture, concerned primarily with runoff and water-flow retardation; and 7 reports of the Bureau of Reclamation, concerned primarily with irrigation and incidental power, flood control, and water-conservation features. The Department also reviewed, through the Division of Water and Power, 48 applications for power permits and licenses referred for comment to the Department by the Federal Power Commission. The coordination activities of the Department in the field of water and power are carried out under a policy which assures that adequate consideration is given to all uses of water so that maximum benefits may be realized.

Members of the staff of the Division of Water and Power represent the Department on the energy conversion and the benefits and costs subcommittees of the Federal interagency river basin committee.

A departmental committee under the chairmanship of the Director of the Division of Water and Power has been established to assist the Secretary and the Assistant Secretary for Water and Power Development in formulating policy in the field of artificial precipitation.

A task force consisting of representatives from all agencies in the Department was established under the chairmanship of the Director of the Division of Water and Power to review and analyze the report of the President's Water Resources Policy Commission.

The position of departmental representative on the interdepartment Radio Advisory Committee has been transferred from the Bureau of Mines to the Division of Water and Power. The Department of Interior now has approximately 3,000 radio stations (exclusive of certain categories of mobile and portable stations) operating on over 200 different frequencies. These are used for communication necessary in the operation of the Department's various agencies.

apacity and generation of plants whose power is marketed by Interior Department agencies and kilowatt-hour sales and revenues, by marketing agency, fiscal year 1951.

Marketing agency	Installed generator capacity, nameplate rating June 30, 1951	Net energy generated 12 months ending June 30, 1951	Energy marketed 12 months ending June 30, 1951	Gross revenues from sale of power 12 months ending June 30, 1951	Average revenue per kilowatt-hour sold 12 months ending June 30, 1951
	Kilowatt	*Kilowatt-hours*	*Kilowatt-hours*		*Mills per kilowatt-hour*
ureau of Reclamation	[1] 3, 989, 500	21, 426, 489, 000	[3] 8, 595, 709, 000	[4] $27, 043, 000	3. 14
onneville Power Administration	[2] 518, 400	[2] 3, 793, 276, 000	[5] 15, 079, 237, 000	[5] 35, 771, 000	2. 37
utheastern Power Administration	[2] 245, 600	[2] 600, 823, 000	600, 823, 000	2, 458, 000	4. 09
uthwestern Power Administration	[2] 157, 000	[2] 491, 580, 000	488, 145, 000	2, 280, 000	4. 67
Total	4, 910, 500	26, 312, 168, 000	24, 763, 914, 000	67, 552, 000	2. 73

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[1] Includes 1,866,000 kilowatts Grand Coulee, 27,000 kilowatts Anderson Ranch, 180,000 kilowatts Davis, 100 kilowatts Marys Lake, and 50,000 kilowatts at Ft. Peck, a Corps of Engineers project.

[2] U. S. Corps of Engineers plants.

[3] Excludes 12,699,649,000 Kwh. deliveries to BPA for resale.

[4] Excludes $8,083,000 sales to BPA for resale.

[5] Includes energy generated at Grand Coulee project.

Bonneville Power Administration

Paul J. Raver, Administrator

FINANCIAL RESULTS OF OPERATIONS [1]

EXCELLENT water conditions permiting the sale of large amounts of interruptible power were primarily responsible for a record growth in fiscal year 1951 revenues. Gross operating revenues approximated $35,600,000, an increase of nearly $4,500,000 over the previous year.

Energy Sales Gain

Sales of energy revealed gains in all customer categories. Revenues from aluminum and other industries, including military establishments, increased $2,416,867 or 16.3 percent, publicly owned utilities $1,524,569 or 18.1 percent, and privately owned utilities $814,409, or 10.7 percent. Industry accounted for 48.3 percent of gross revenues, publicly owned utilities 27.9 percent, privately owned utilities 23.6 percent, and other electric revenues 0.2 percent. Revenues by class of customers through fiscal year 1951 are shown in table 1.

Net Revenues High

Annual independent audit of the Bonneville Power Administration accounts by Arthur Andersen & Co. is expected to show net revenues of $13,500,000 after deducting all expenses of operation, maintenance, administration, marketing, depreciation, and interest allocated to power at the rate of 2½ percent per annum. Accounts of the Columbia River power system include power components of the Bonneville Dam project and Grand Coulee Dam of the Columbia Basin project. Gross and net revenues on a cumulative basis from beginning of operations to June 30, 1951, approximate $224,500,000 and $68,100,000 respectively.

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[1] Revenue and Operating figures are estimated on basis of first 10 months of actual operating results and are projected for the last two months of fiscal year, to meet publication dates.

Table I.—*Revenues by class of customer through fiscal year 1951*

Class of Customer	1944 and prior	1945	1946	1947	1948
Industry:					
Aluminum	$24, 350, 433	$11, 838, 156	$7, 987, 226	$9, 045, 540	$10, 453, 42
Other industry [1]	5, 185, 494	4, 171, 469	3, 108, 749	1, 836, 349	1, 915, 88
Publicly owned utilities	3, 768, 642	2, 141, 635	1, 711, 822	2, 778, 765	4, 318, 12
Privately owned utilities	7, 152, 532	4, 752, 021	5, 209, 344	6, 127, 669	7, 633, 05
Other electric revenues	130, 123	86, 737	[2] 1, 867, 144	[3] 2, 102, 606	193, 23
Total operating revenues	40, 587, 224	22, 990, 018	19, 884, 285	21, 890, 929	24, 513, 71

Class of Customer	1949	1950	1951	Total to June 30, 1951	1951 percentage (dollar revenue)
Industry:					
Aluminum	$11, 741, 530	$12, 133, 254	$13, 515, 836	$101, 065, 400	37. 9
Other industry [1]	2, 219, 819	2, 677, 580	3, 711, 865	24, 827, 209	10. 4
Publicly owned utilities	5, 893, 436	8, 409, 428	9, 933, 997	38, 955, 845	27. 8
Privately owned utilities	7, 756, 301	7, 587, 963	8, 402, 372	54, 621, 253	23. 5
Other electric revenues	209, 943	384, 609	57, 543	5, 031, 935	. 1
Total operating revenues	27, 821, 029	31, 192, 834	[4] 35, 621, 613	[4] [5] 224, 501, 642	100. 0

[1] Includes military establishments.

[2] Includes $1,789,443 of contract cancellations applicable to fiscal year 1946. (The total of $3,802,415 was apportioned over a period of 12 months.)

[3] Includes $2,012,972 of contract cancellations applicable to fiscal year 1947. (The total of $3,802,415 was apportioned over a period of 12 months.)

[4] Includes 10 months actual revenue (to Apr. 30, 1951) and 2 months estimated for fiscal year 1951.

[5] As of June 30, 1951, the Administration had collected and deposited in the U. S. Treasury power-revenue receipts totaling an estimated $210,891,457 (actual to May 31, 1951, $207,278,840 plus estimated for June 1951, $3,612,617) and general fund receipts of an estimated $5,724,521 (actual to May 31, 1951, $5,709,521 plus estimated for June 1951, $15,000). Accounts receivable, accrued unbilled revenues, unbilled exchange sales, miscellaneous adjustments, and minor items accounts for the difference between total revenues and total receipts deposited by the Administration with the U. S. Treasury.

Low Rate Justified

Favorable operating results for fiscal year 1951, accumulated net revenues available from prior years, and the general financial outlook for the next few years confirmed the Administration's decision of December 1949 to continue for another 5-year period the basic $17.50 per kilowatt-year wholesale power rate. Some increase in the wholesale power rate level may be required in December 1954, the next rate adjustment date, in view of increased construction costs of dams now being built and scheduled to begin operations between now and December 1954.

The Administration's wholesale power contracts require adjustments of rates every 5 years provided the general level of wholesale commodity prices has increased sufficiently over the preceding base period.

Receipts Pay All Costs

Cash receipts through June 30, 1951, will total $216,600,000, exceeding by a substantial margin the amounts required for current expenses and scheduled repayments of construction costs. Power revenues are required to repay with interest the investment in power facilities of the Columbia River system, current expenses for operation and maintenance, and, without interest, a substantial portion of the construction costs of the Columbia Basin project allocated to irrigation.

Columbia Basin Repayment

Power sales receipts returned or scheduled for return to the Reclamation fund to June 30, 1951, by the Bonneville Power Administration for the account of the Columbia Basin project totaled $63,618,680. These returns were applied to repayment of:

Expenses of operation and maintenance of the dam, reservoir, power plant, and appurtenant works	[1] $13, 907, 000
3 percent interest on construction costs allocated to power	26, 719, 000
Construction costs, including replacements	22, 992, 680
Total	63, 618, 680

[1] Includes approximately $1,966,000 allocated to irrigation for cost accounting purposes but repaid from power revenues.

Repayment of $22,992,680 of construction costs and replacements is nearly three times the originally scheduled repayments of $8,009,283. Moreover, the repayment represents 16½ percent of the $138,371,000 of construction costs and replacements allocated to power as of June 30, 1951, based on a 15-unit power development. Power investment will be repaid by 1977 according to present estimates, or only 35 years after the start of commercial power generation in fiscal year 1942. Net power revenues will then be applied to the return of irrigation construction costs.

Bonneville Dam Repayment

Power sales receipts returned to the general fund of the Treasury to June 30, 1951, for the account of the Bonneville Dam project total $38,163,000. These repayments exceed power costs including operation, maintenance, depreciation and interest by 42 percent and place the payout of the power investment substantially ahead of scheduled requirements of the 50-year payout period. The gross repayment of $38,163,000 has met operation and maintenance expenses of $6,444,000, interest expense of $14,953,000 and left $16,766,000 applied to repayment of the capital investment of $59,738,000 allocated to power, representing approximately 69 percent of the total capital investment in the project. Hence, 28 percent of the power capital investment has been repaid in the first 7 years, or only 14 percent of the payout period.

Transmission Repayment

Gross cash receipts to June 30, 1951, of $216,600,000 less repayments of $38,163,000 for Bonneville Dam and $63,618,680 for Coulee Dam and less $1,830,000 advanced to the Reclamation fund on account of fiscal year 1952 estimated expenses, leaves $112,988,320 available for repayment of the expenses of and investment in the Administration's transmission system. This amount has been applied to the return of the following accounts:

Expenses of operation, maintenance, marketing, administration, etc	$38, 151, 534
Interest expenses	18, 486, 659
Capital investment, including replacements	50, 131, 141
Subtotal	106, 769, 334
Unapplied cash receipts carried forward	5, 718, 986
Amount carried forward in continuing fund	500, 000
Total	112, 988, 320

The repayment of $50,131,141 represented the return of approximately 25.43 percent of the cumulative capital investment of $197,161,014 as of June 30, 1951.

SUMMARY OF OPERATIONS

Energy Production

Power generated for the Administration at Bonneville and Grand Coulee power plants in fiscal year 1951 exceeded 16 billion kilowatt-hours and represented over half of the power produced in the Pacific Northwest. Power production for the year revealed an increase of 16 percent over fiscal year 1950 and brought total production from the two Columbia River plants since July 1939 to 97 billion kilowatt-hours.

A new system peak was recorded between 10 and 11 a. m, June 11, 1951, with an all-time high coincidental demand on Bonneville and Grand Coulee plants of 2,535,000 kilowatts. The new peak represents a 20-percent increase over last year's maximum demand of 2,106,000 kilowatts during January 1950.

Energy production by years at Bonneville and Grand Coulee plants is shown in table 2, with peak demand and energy data in chart 1. Prepared on a quarterly basis to indicate more clearly general trends of Bonneville Power Administration system growth and development, the chart shows the effect of postwar economic conditions in the area. Since the fall of 1946, maximum system demands have continuously exceeded the name-plate rating of installed generators.

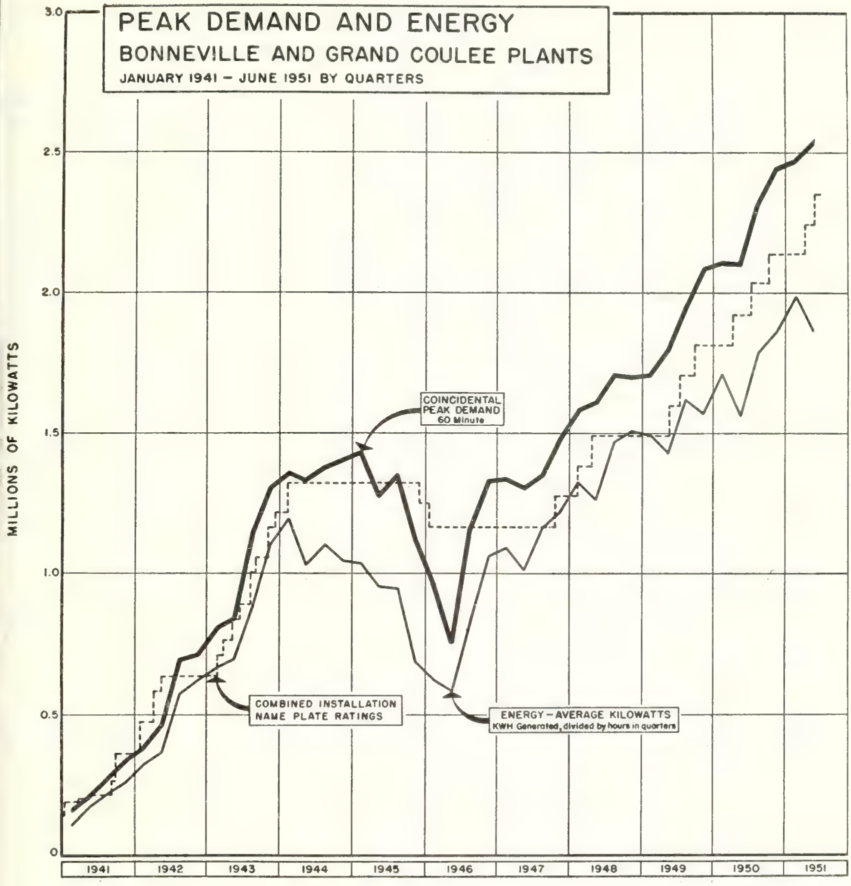


CHART 1.

Energy Receipts and Deliveries

Electric energy receipts and deliveries on the Bonneville Power Administration transmission system cover many complex transactions in addition to receipts from Bonneville and Grand Coulee generation and deliveries by sales. Bonneville's grid represents the backbone of the interconnected transmission systems of public and private utilities in the Pacific Northwest. Substantial quantities of energy are received and delivered as transfers from other utilities.

Also included are receipts from storage by the Administration in non-Federal reservoirs and for storage by non-Federal utilities in the Grand Coulee Reservoir. Disposition of energy may also include deliveries from storage in Grand Coulee or to storage in other reservoirs, energy transfers for the Bureau of Reclamation from Grand

Coulee, energy used by the Administration and energy losses in transmission and transformation.

Table 2.—*Generation at Bonneville and Grand Coulee plants for Bonneville Power Administration, fiscal years 1939–51 (includes estimates for June 1951*

[Thousands of kilowatt-hours]

Fiscal years ending June 30—	Bonneville generation	Grand Coulee generation	Total generation for Bonneville Power Administration
1939	34,874		34,874
1940	208,426		208,426
1941	894,177	7,455	901,632
1942	1,807,309	741,844	2,549,153
1943	2,801,480	2,816,956	5,618,436
1944	3,488,874	5,750,950	9,239,824
1945	3,391,128	5,660,446	9,051,574
1946	2,674,834	3,561,329	6,236,163
1947	3,695,255	5,058,482	8,753,737
1948	3,991,860	6,894,047	10,885,907
1949	3,868,558	9,057,230	12,925,788
1950	3,689,309	10,451,524	14,140,833
1951	3,778,400	[1] 12,648,900	16,427,300
Total	34,324,484	[1] 62,649,163	96,973,647

[1] Includes energy transferred for Bureau of Reclamation.

Table 3, Electric Energy Account, summarizes energy receipts and deliveries.

Table 3.—*Electric energy account, fiscal year ended June 30, 1951 (includes estimates for June)*

Energy received (thousands of kilowatt-hours):	
Energy generated for Bonneville Power Administration:	
Bonneville	3,778,400
Grand Coulee	[1] 12,648,900
Total	16,427,300
Power purchased and interchanged in	1,178,000
Total received	17,605,300
Energy delivered (thousands of kilowatt-hours):	
Sales	15,041,900
Power interchanged out	1,191,600
Used by Administration	18,000
Total delivered	16,251,500
Energy losses in transmission and transformation	1,353,800
Losses as percent of total energy received	7.7
Maximum demand on Bonneville and Grand Coulee plants (kilowatts):	
June 11, 1951, 10–11 a. m., Pacific standard time	2,535,000
Load factor, total generated for Bonneville Power Administration, percent	74.0

[1] Includes energy transferred for Bureau of Reclamation.

Sales Exceed 15 Billion Kilowatt-Hours

Energy sales to customers of the Bonneville Power Administration exceeded 15 billion kilowatt-hours during fiscal year 1951, an increase of 15 percent over the previous year. Energy losses in transmission and transformation of power were 1.4 billion kilowatt-hours or 7.7 percent of total energy received on the system.

Sales of electric energy to other utilities, both publicly and privately owned, increased 11 percent over fiscal year 1950. Sales to all industries increased 17 percent with sales to aluminum industries increasing 11 percent. Continuous favorable water conditions during the 1950–51 storage season made possible the delivery of large amounts of interruptible power to industries.

Composite Average Rate 2.43 Mills

During the 13 years' operation ending June 30, 1951, the Administration has delivered 90,415,833,000 kilowatt-hours of energy at a composite average rate of 2.43 mills per kilowatt-hour. Sales to publicly owned utilities for this period were 13.7 billion kilowatt-hours at an average rate of 2.84 mills. Privately owned utilities received 22.9 billion kilowatt-hours at an average rate of 2.40 mills, and industries 53.8 billion kilowatt-hours at an average rate of 2.34 mills. Power sales to the aluminum plants, initially established in the Pacific Northwest primarily to meet World War II production needs, were 45.8 billion kilowatt-hours at an average rate of 2.21 mills. Sales to industries other than aluminum including sales to military establishments were 8.0 billion kilowatt-hours at an average rate of 3.06 mills.

Electric energy sales by class of customer for each of the 13 years' operation are shown in table 4. The monthly detail of energy deliveries to these four classes of customers is shown in chart 2 for the period from January 1941 to date. This chart portrays the relative size and growth of energy sales to aluminum plants, other industries, privately owned utilities and publicly owned utilities.

Rate Schedules Summarized

A summary of sales for fiscal year 1951 classified by rate schedules is shown in table 5. Approximately three-fourths of energy sales during the fiscal year were made under the C schedule at an average rate of 2.16 mills. This is the kilowatt-year rate for firm power delivered anywhere from the transmission system and is also used with special measured demand provisions for sales of interruptible power. Sales are generally made under this rate to industries operating at high load factor and to utilities having substantial generating facilities.

Table 4.—*Electric energy sales by class of customer fiscal years 1939–51 (includes estimates for June 1951)*

[Thousands of kilowatt-hours]

Fiscal years ending June 30	Industry		Publicly owned utilities	Privately owned utilities	Total
	Aluminum	Other industries [1]			
1941 and prior	522,982	4,829	35,242	536,555	1,099,608
1942	1,845,249	79,155	142,491	357,704	2,424,599
1943	3,588,848	507,196	435,289	739,076	5,270,409
1944	5,453,893	1,022,477	727,642	1,467,304	8,671,316
1945	4,667,381	964,724	823,822	2,057,203	8,513,130
1946	2,492,985	799,378	635,531	1,902,990	5,830,884
1947	4,212,413	626,688	1,044,784	2,377,887	8,261,772
1948	4,902,465	646,913	1,560,755	3,180,993	10,291,126
1949	5,665,746	880,017	2,078,931	3,343,983	11,968,677
1950	5,863,465	1,016,100	2,844,128	3,318,719	13,042,412
1951	6,548,300	1,505,500	3,403,700	3,584,400	15,041,900
Total to June 30, 1951	45,763,727	8,052,977	13,732,315	22,866,814	90,415,833

[1] Includes military establishments.

Table 5.—*Electric energy sales by rate schedules, fiscal year ended June 30, 1951 (includes estimates for June)*

Rate schedule	Energy	Revenue [1]	Mills per kilowatt-hour
	Thousands of kilowatt-hours		
C-3, C-4:			
Industries	7,537,500	$15,512,500	2.06
Utilities	4,147,300	9,716,100	2.34
Subtotal	11,684,800	25,228,600	2.16
F-2, F-3, F-4:			
Industries	277,200	961,000	3.47
Utilities	68,100	321,400	4.72
Subtotal	345,300	1,282,400	3.71
A-3, A-4: Utilities	20,500	66,700	3.25
E-2, E-3, E-4: Utilities	2,210,800	7,104,400	3.21
Experimental, H-1, H-2, H-3, and exchange (industries and utilities)	780,500	1,951,200	2.50
Total sales	15,041,900	35,633,300	2.37
Reconciliation with accounting records		[1] 69,230	
Other electric revenues		57,543	
Total operating revenues		35,621,613	

[1] Sales statistics include billing adjustments or revisions made subsequent to close of accounting records.

Major features of rate schedules:

C-3, C-4:	Kilowatt-year rate for transmission system firm power.
F-2, F-3, F-4:	Demand-energy rate for firm power.
A-3, A-4:	Kilowatt-year rate for at-site firm power.
E-2, E-3, E-4:	Demand-energy rate for firm power for resale to ultimate consumers.
Experimental:	Energy rate of 2.5 mills for developmental purposes.
H-2, H-3:	Energy rate for dump, emergency, or breakdown service.
Exchange:	Gross exchange account deliveries at dump energy rate.
Interruptible:	Billed under C-4 and F-4 schedules with special measured demand provisions.

Other sales were made principally under the E schedule to utilities purchasing all or substantially all of their power requirements from the Administration. Sales under the F schedule were made to utilities and industries requiring power at low load factor use and under the H schedule for dump, exchange or experimental purposes.

The Administration served 108 customers at the end of fiscal year, including 77 publicly owned distributors of power, 19 industrial customers 4 military establishments, and 8 privately owned utilities. Five customers were added during the year—the cities of McCleary, Wash., and Springfield, Oreg., the Lincoln Electric Cooperative at Kalispell, Mont., the Bureau of Reclamation, and California-Oregon Power Co. No service to customers was discontinued during the year.

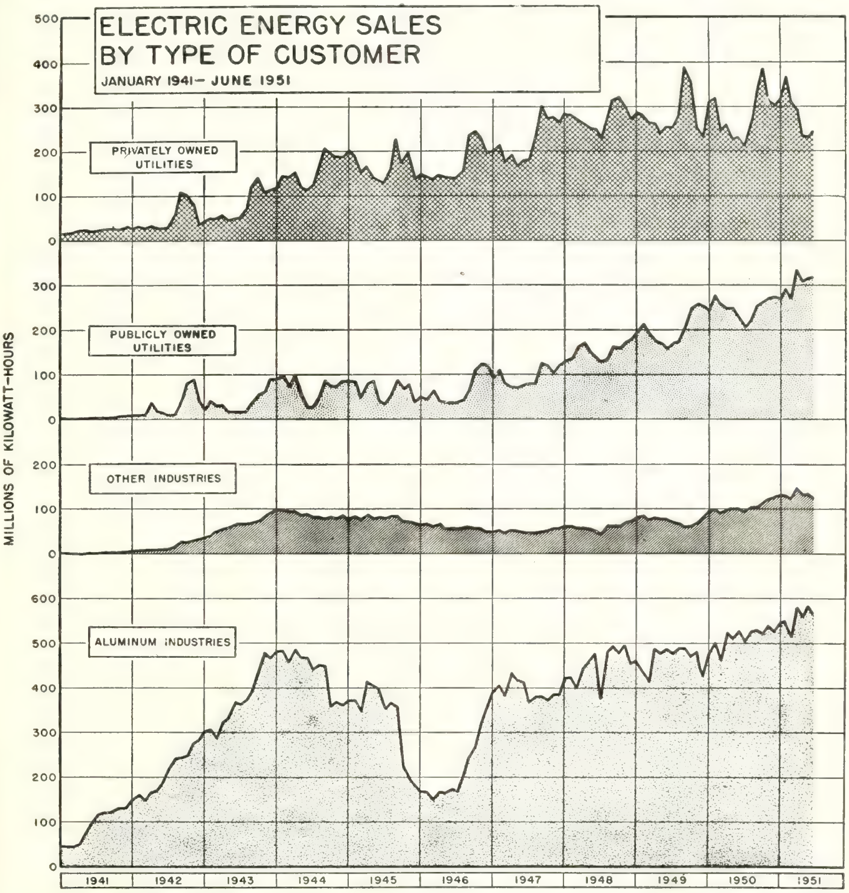


CHART 2.

Low Rates Stimulate Power Use

All long-term wholesale power contracts with distributors of Bonneville power contain provisions regarding resale rates and principles of operation to insure distribution for the benefit of the general public, and particularly domestic and rural consumers. The direct relationship of increased use of electric energy to the influence of lower rates is well illustrated in table 6. This shows the trends from 1938 to date on the average use and price for residential home and farm service in the Pacific Northwest as compared with the national average.

Added Generating Capacity

Four additional units have been installed in the right powerhouse at Grand Coulee during the year. These units have increased the nameplate rating of the system to 2,354,000 kilowatts with maximum generating capability of 2,604,000 kilowatts. The final units scheduled for October 1951 will complete the 18-unit installation at Grand Coulee.

Table 6.—*Residential and rural service, average use per customer and average price per kilowatt-hour*

Calendar year	Kilowatt-hour per customer		Price per kilowatt-hour	
	United States total	Oregon and Washington	United States total	Oregon and Washington
			Cents	*Cents*
1938	902	1, 410	4. 02	[1] 2. 65
1939	953	1, 467	3. 87	[1] 2. 55
1940	1, 006	1, 589	3. 74	2. 27
1941	1, 044	1, 776	3. 65	2. 08
1942	1, 088	2, 024	3. 57	1. 94
1943	1, 135	2, 279	3. 50	1. 84
1944	1, 225	2, 504	3. 41	1. 74
1945	1, 305	2, 801	3. 32	1. 69
1946	1, 418	3, 219	3. 13	1. 58
1947	1, 546	3, 696	3. 00	1. 49
1948	1, 674	4, 160	2. 92	1. 41
1949	1, 806	4, 503	2. 87	1. 38
1950	1, 951	4, 867	2. 81	1. 36

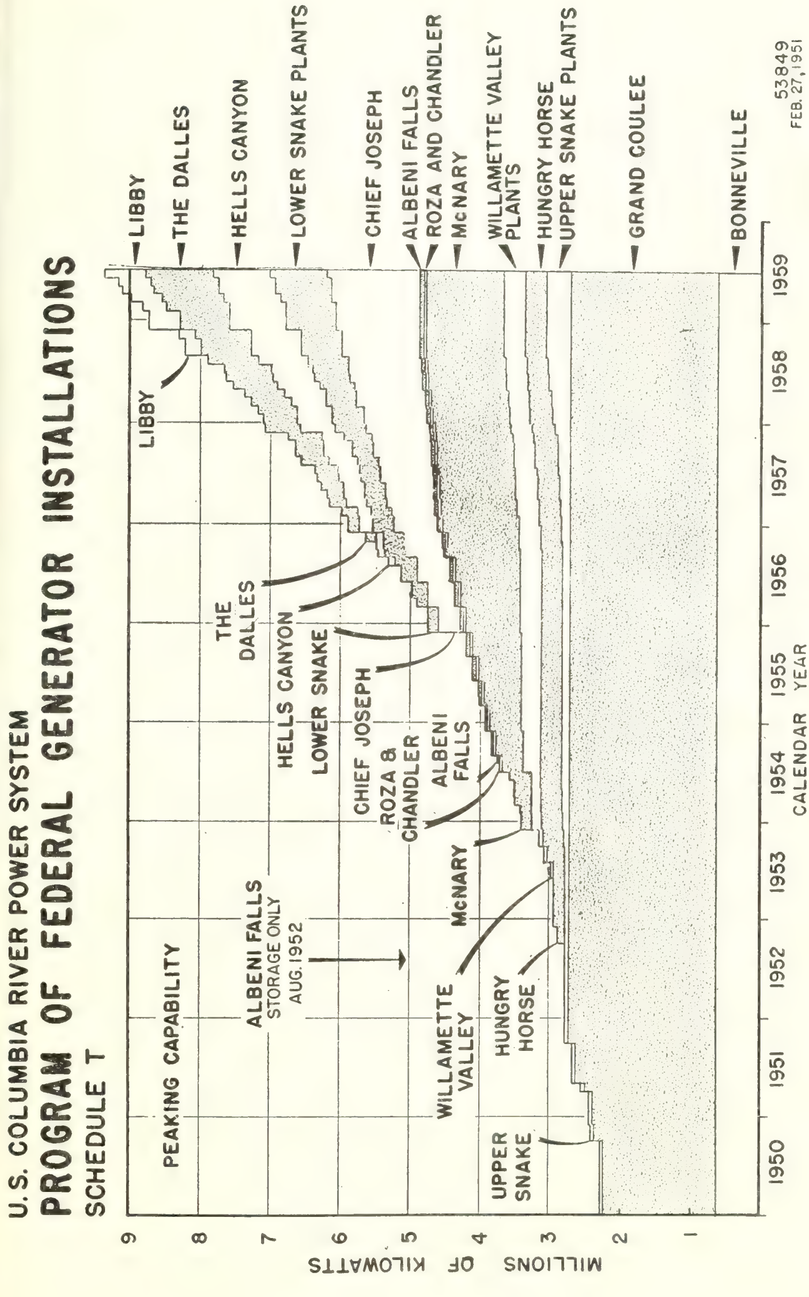
[1] Partially estimated from State commission data.

Source: Edison Electric Institute.

The Federal projects existing, authorized, or recommended by the Corps of Engineers and the Bureau of Reclamation are shown in table 7. Chart 3 shows peaking capabilities of present installations and installations proposed under schedule T, the current recommended schedule of development for federal projects. The multipurpose projects listed are needed to meet flood control, navigation, irrigation, and power requirements of the region. With complete development of these projects a total of 27.3 million acre-feet of storage space will be available for flood control operations and over 12 million kilowatts of peaking capability will be available to meet the region's power needs.

Non-Federal Additions

Only a few additions were made to non-Federal utility generating facilities during the year. Seattle City Light completed the installation of an additional 60,000-kilowatt unit at its Gorge plant and the California Oregon Power Co. completed its Slide Creek and Soda



U.S. COLUMBIA RIVER POWER SYSTEM

PROGRAM OF FEDERAL GENERATOR INSTALLATIONS

SCHEDULE T

CHART 3.

Table 7.—*General specifications—existing, authorized and recommended projects, installations and capabilities correspond to a coordinated system operation of plants shown*

	Location	Plant installations		Nominal prime power average kilowatts [2]	Pool elevation (feet)	Usable storage (acre-feet)	Average head (feet)	Initial date in service	Principal purposes
		Units	Kilowatts [1]						
Existing projects:									
Grand Coulee	Washington	18	[3]1, 944, 000	[4]1, 557, 000	1, 288. 0	5, 212, 000	330	March 1941	Power, irrigation, navigation, and flood control.
Bonneville	Washington-Oregon	10	518, 400	476, 000	72. 0		60	January 1938	Power and navigation.
Minidoka	Idaho	7	13, 400	6, 000	4, 245. 0	95, 200	49	January 1909	Do.
Boise diversion	do	3	1, 500	2, 000	2, 800. 0		31	January 1912	Do.
Black Canyon	do	2	8, 000	9, 000	2, 947. 0	14, 800	94	January 1925	Do.
Anderson ranch	do	2	27, 000	21, 000	4, 196. 0	464, 200	260	December 1950	Power, irrigation, and flood control.
Projects under construction:									
Hungry Horse	Montana	4	285, 000	187, 000	3, 559. 0	2, 980, 000	377	September 1952	Power, irrigation, navigation, and flood control.
Albeni Falls	Idaho	3	42, 600	23, 000	2, 062. 5	1, 140, 000	24	August 1952	Power and navigation.
Chief Joseph	Washington	18	1, 152, 000	792, 000	937. 5		171	December 1955	Power, irrigation, and navigation.
McNary	Washington-Oregon	14	980, 000	617, 000	340. 0		87	December 1953	Do.
Lookout Point (Meridian)	Oregon	3	115, 000	36, 000	929. 0	368, 000	228	July 1954	Power, navigation, and flood control.
Dexter	do	1	15, 000	12, 000	695. 0		53	July 1954	Power.
Detroit	do	2	100, 000	30, 000	1, 569. 0	340, 000	299	June 1953	Power, navigation and flood control.
Big Cliff	do	1	18, 000	10, 000	1, 197. 0		81	December 1953	Power.
Authorized projects:									
Libby	Montana	6	588, 000	244, 000	2, 440. 0	4, 250, 000	300	September 1958	Power, navigation, and flood control.
Priest Rapids	Washington	18	954, 000	715, 000	550. 0	[5]2, 100, 000	129		Do.
John Day	Washington-Oregon	13	1, 105, 000	715, 000	255. 0	[5]2, 000, 000	95		Power, irrigation, navigation, and flood control.
The Dalles	do	15	1, 050, 000	687, 000	160. 0		88	November 1956	Power, irrigation, and navigation.
Ice Harbor	Washington	4	260, 000	204, 000	440. 0		93	December 1955	Do.
Lower Monumental	do	4	240, 000	194, 000	533. 0		89	December 1957	Power, navigation, and irrigation.
Little Goose	do	4	260, 000	209, 000	633. 0		96	December 1958	Power and navigation.
Lower Granite	do	4	220, 000	170, 000	715. 0		77	December 1959	Do.
Hills Creek	Oregon	1	20, 000	14, 000	1, 510. 0	221, 000	204	December 1955	Power, irrigation, navigation, and flood control.
Cougar [6]	do	1	25, 000	15, 000	1, 683. 0	182, 000	418		Do.
Green Peter [6]	do	2	81, 000	22, 000	984. 0	322, 000	315		Do.
White Bridge [6]	do	1	15, 000	9, 000	670. 0		93		Power.

Roza	Washington	2	10, 000	4, 000			140	July 1954	Power and irrigation.
Chandler	do	2	12, 000	12, 000			118	December 1954	Do.
Palisades	Idaho	4	112, 500	41, 000	5, 620. 0	1, 200, 000	144	April 1957	Power, irrigation, and flood control.
American Falls	do	3	30, 000		4, 354. 5	1, 700, 000	80	October 1953	Do.
Recommended projects:									
Hells Canyon	Oregon-Idaho	8	800, 000	688, 000	2, 077. 0	3, 880, 000	510	August 1956	Power, navigation, and flood control.
Upper Scriver	Idaho	3	27, 500	26, 000	4, 505. 0		400	October 1956	Power and irrigation.
Lower Scriver	do	2	60, 000	60, 000	4, 060. 0		794	January 1958	Do.
Garden Valley	do	4	60, 000	52, 000	3, 266. 0	843, 000	334	July 1957	Power, irrigation and flood control.

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[1] Name-plate ratings.

[2] Average capability during storage draw-down period.

[3] 17 of ultimate 18 units are now in operation and the final unit is being installed.

[4] Pumping requirements of the Columbia Basin project have been deducted.

[5] Flood control storage only.

[6] Power facilities are not authorized. White Bridge is not authorized but is required with installation of generating units at Green Peter.

NOTE.—Project characteristics include revisions made since the 1951 advance program report was issued.

Springs plants, and added a third 13,300 kilowatt unit in its Toketee Falls plant. Planned additions of the non-Federal utilities are shown in table 8.

Table 8.—*Non-Federal generating program—projects under construction and installation schedule or certified by defense electric power administration*

Utility	Unit No.	Name-plate rating (thousand watts)	Installation date
City of Seattle:			
Ross storage: elevation 1,600 feet; 1.4 million a. f., 1.023 million a. f. of usable storage after units are installed (1,600 to 1,475 feet).			August 1953.
Ross plant	1	90	December 1952.
	2	90	February 1953.
	3	90	December 1953.
		270	
City of Tacoma:			
Cushman Plant No. 2	3	32	December 1951.
Chelan County pud:			
Rock Island	5	25	November 1952.
(Owned by PSP&L Co.)	6	25	December 1952.
	7	25	January 1953.
	8	25	March 1953.
	9	25	May 1953.
	10	25	June 1953.
		150	
Pend Oreille County pud:			
Box Canyon		60	June 1954.
California Oregon Power Co.:			
Fish Creek		11	October 1951.
Upper Clearwater		15	October 1952.
Lower Clearwater		26	October 1952.
Upper Lemolo		20	October 1953.
Lower Lemolo		20	October 1953.
		92	
Idaho Power Co.:			
C. J. Strike	1	27	January 1952.
	2	27	February 1952.
	3	27	April 1952.
		81	
Montana Power Co.:			
F. W. Bird (steam)	1	60	September 1951.
Portland General Electric Co.:			
Station "M" (River Mill)	5	5	December 1951.
Washington Water Power Co.:			
Cabinet Gorge	1	50	September 1952.
	2	50	October 1952.
	3	50	November 1952.
	4	50	April 1953.
		200	
Pacific Power & Light Co.:			
Yale	1	50	November 1952.
	2	50	January 1953.
		100	

NOTE.—Schedules above include revisions made since the 1951 advance program report was issued.

Northwest Power Pool

Generation during fiscal year 1951 by the principal electric utility systems of the Pacific Northwest region is shown in table 9. All of

Table 9.—*Generation by the principal electric utility systems of the Pacific Northwest—fiscal year 1951*

Utilities	Billion kilowatt-hours	Percent of total generation
Publicly owned:		
Bonneville Power Administration	16.4	59.0
Seattle City Light	1.3	4.7
Tacoma City Light	.9	3.2
Total publicly owned	18.6	66.9
Privately owned:		
Puget Sound Power & Light Co	1.6	5.8
Washington Water Power Co	1.4	5.0
Pacific Power & Light Co	.8	2.9
Portland General Electric Co	.7	2.5
Montana Power Co	2.9	10.4
Idaho Power Co	1.8	6.5
Total privately owned	9.2	33.1
Total generation [1]	27.8	100.0

[1] The above utilities are members of the Northwest Power Pool. Utah Power & Light Co. and British Columbia Electric Co. are also members of the pool, but are not included above because their major service areas lie outside the Pacific Northwest region.

the utilities are members of the Northwest Power Pool. Utah Power & Light Co. and British Columbia Electric Co. are also members of the pool but are not included since these major service areas are outside the Pacific Northwest.

The Administration supplied 59 percent of the total energy generated by the major utilities serving the region, as shown in chart 4. In addition to the power requirements of industries and nonpool member utilities, a maximum hourly delivery of almost 800,000 kilowatts and approximately 4,300,000,000 kilowatt-hours was provided by the Administration for use by other pool utilities in meeting their requirements.

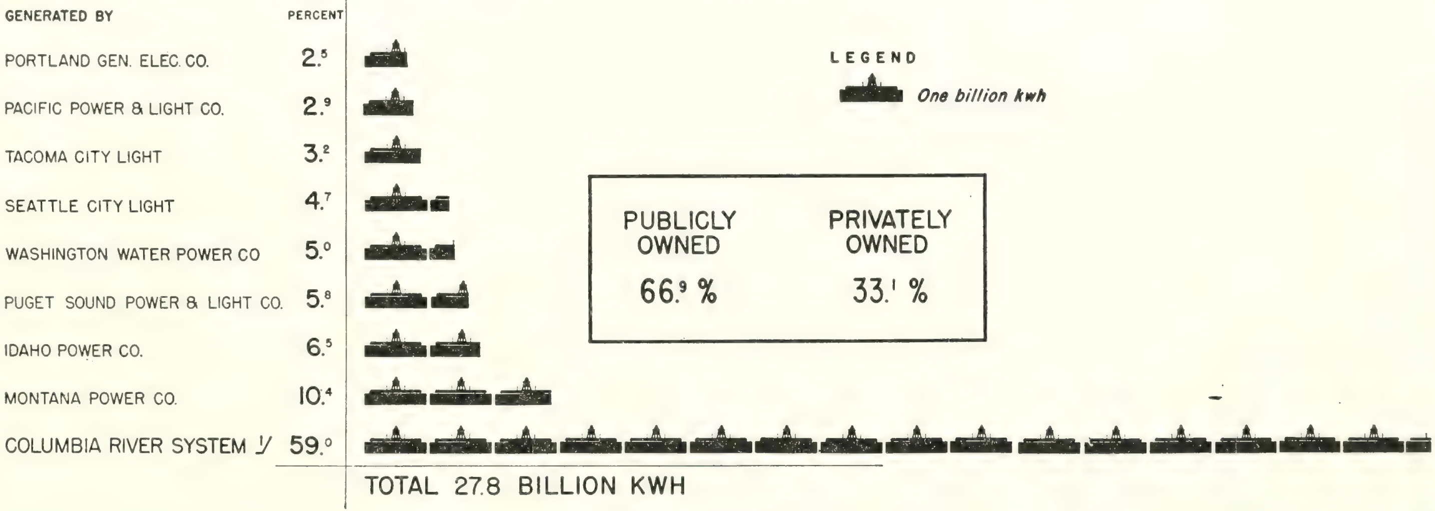
Transmission Additions

Major additions to the Administration's transmission facilities during the year brought relief to several areas of the region confronted by serious power deficits. Completion of the second Coulee-Snohomish 230-kilovolt line made it possible to bring additional power into the Puget Sound area. This released capacity on the Coulee-Columbia-Covington circuits which together with the completion of the Covington-Olympia 230-kilovolt line increased the transmission capacity to the Longview-Portland area. The construction of a 115-kilovolt line into the southern coastal area of Oregon made additional power available to a rapidly expanding lumbering and wood products industry. Chart 5 shows the BPA transmission system as of July 1, 1951. Facilities approved or under construction, including the proposed 1952 program, are shown in broken lines.

POWER GENERATED

BY THE PRINCIPAL ELECTRIC UTILITIES OF THE PACIFIC NORTHWEST [2]

YEAR ENDED JUNE 30, 1951



[1] BONNEVILLE AND GRAND COULEE POWER PLANTS OPERATED BY THE CORPS OF ENGINEERS AND BUREAU OF RECLAMATION RESPECTIVELY.

[2] THE ABOVE UTILITIES ARE MEMBERS OF THE NORTHWEST POWER POOL. UTAH POWER & LIGHT COMPANY AND BRITISH COLUMBIA ELECTRIC COMPANY ARE ALSO MEMBERS OF THE POOL, BUT ARE NOT INCLUDED ABOVE BECAUSE THEIR MAJOR SERVICE AREAS LIE OUTSIDE THE PACIFIC NORTHWEST REGION.

SOURCE: WEEKLY OPERATING REPORTS OF NORTHWEST POWER POOL.

CHART 4.

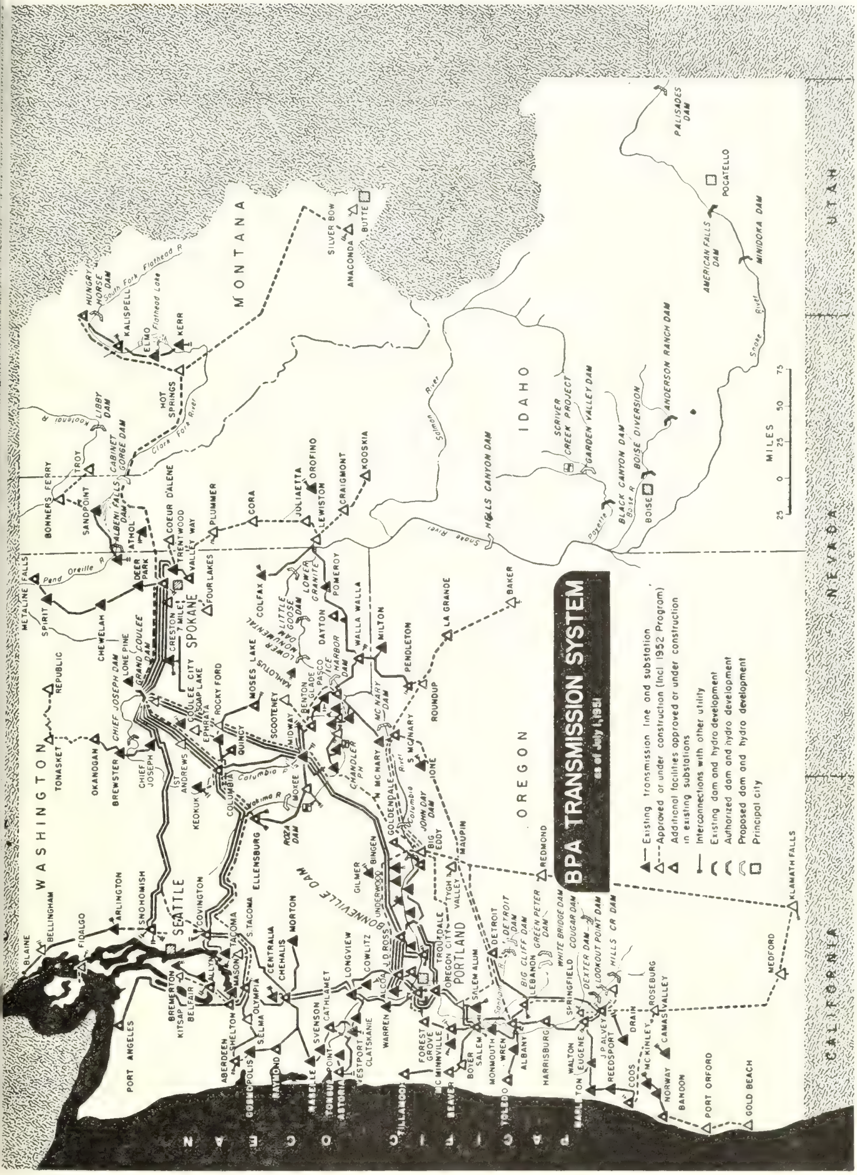

BPA TRANSMISSION SYSTEM
as of July 1, 1951
Existing transmission line and substation
Approved or under construction (Incl 1952 Program)
Additional facilities approved or under construction in existing substations
Interconnections with other utility
Existing dam and hydro development
Authorized dam and hydro development
Proposed dam and hydro development
Principal city
MILES
25 0 25 50 75
WASHINGTON
OREGON
IDAHO
MONTANA
CALIFORNIA
NEVADA
UTAH
PACIFIC OCEAN
SEATTLE
SPOKANE
PORTLAND
GRAND COULEE DAM
CHIEF JOSEPH DAM
BONNEVILLE DAM
MC NARY DAM
HUNGRY HORSE DAM
HELLS CANYON DAM
BOISE
POCATELLO
BUTTE
Columbia River
Snake River

CHART 5.

Circuit Miles Added

A tabulation of construction completed during the fiscal year indicates that 330 circuit miles of high-voltage lines and 15 substations were added to the Bonneville transmission grid. This results in a total of 4,370 circuit miles of line and 123 substations serving portions of the four Northwest States. The transmission line total is made up of 1,995 miles of 230,000-volt line, 2,095 miles of 115,000-volt line, and 280 miles of lower-voltage line, as shown in chart 6.

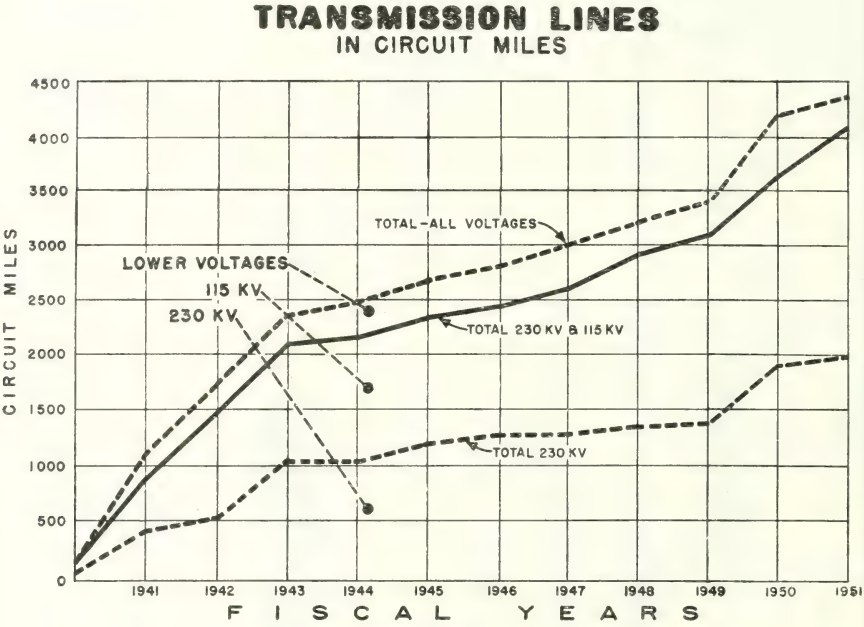


CHART 6.

New Substation Capacity

Substation capacity as shown on chart 7 was increased by 346,850-kilovolt-amperes, bringing the total transformer capacity to 3,112,825-kilovolt-amperes under self-cooled conditions and a maximum of 3,870,325-kilovolt-amperes when forced-cooled. Additional static capacitors with a capacity of 171,400-kilovolt-amperes were installed bringing the total of static capacitors on the system to 626,400-kilovolt-amperes. Installation of a 50,000-kilovolt-ampere synchronous condenser brings the total system capacity of this type of equipment to 357,500-kilovolt-amperes. The combined capacity of the static capacitors and synchronous condensers on the system are indicated by the reactive capacity curve on chart 7.

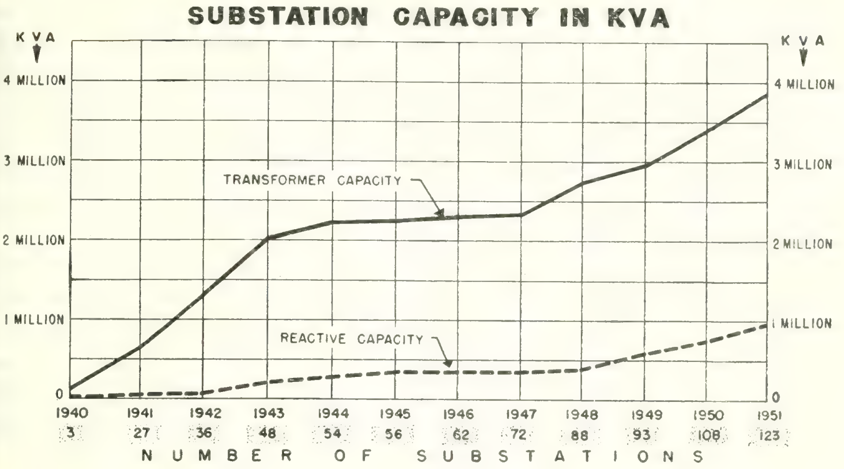


CHART 7.

Major lines energized during the year follow:

Location	Date energized	Structure miles	Kilovolts
Eugene-J. P. Alvey	Oct. 6, 1950	13	115
Mapleton-Coos	Oct. 25, 1950	65	115
Columbia-Ephrata	Nov. 5, 1950	26	115
Newport-Sandpoint	Nov. 7, 1950	24	115
Grand Coulee-Snohomish No. 2	Nov. 19, 1950	73	230
Olympia-Covington	Dec. 3, 1950	60	230
McKinley-Bandon	Dec. 13, 1950	22	115
Lebanon-J. P. Alvey	Mar. 18, 1951	40	[1] 230

[1] 115, kilovolts operation.

Special Projects

First leg of the microwave communication network was placed in operation linking the major power facilities between the Puget Sound and the Portland-Vancouver areas. This provides voice communication between dispatching centers, substation operators, and the Portland-Vancouver offices. Its use will later be expanded to telemetering, relaying, and fault location operations.

A new type of undertaking for Bonneville engineers was the laying of a high-voltage submarine power cable from Fidalgo Island, in the San Juan group, across Rosario Strait to Decatur Island, and from Decatur Island across Lopez Sound to Lopez Island. The cable carries Columbia River power to the San Juan Islands in Puget Sound to serve 1,200 customers of the Orcas Power & Light Co.

Preventive Maintenance

An annual threat facing the Bonneville Power system is the failure to obtain sufficient appropriated funds to allow the formulation of a preventive-maintenance program adequate to assure reliable service to its customers, including important defense plants and military establishments. Extremely heavy loading of transmission lines, accelerated construction schedules, and the growing expanse and complexity of the network contribute to a critical operating instability. This can only be ameliorated by applying the insurance of the most highly advanced type of protective equipment and an adequate maintenance reserve.

Application of the microwave system to line relaying and telemetering is acknowledged as the ultimate in preventing costly and hazardous disruptions of service caused by breakup of a system resulting from a comparatively minor fault occurring on an unstable system. However, it may be found advisable to delay completion of this microwave network until sufficient funds for maintenance of the equipment is assured.

RECOMMENDATIONS

Bonneville Power Administration, supplying over half the power needs of the Pacific Northwest, has a heavy and continuing responsibility as a public utility. Defense production as well as the economic growth and development of the region are largely dependent upon adequate supplies of low-cost hydroelectric power from Federal multipurpose dams.

Consideration by the Congress of the following specific recommendations would, in the opinion of the Department, go far in enabling the Administration to carry out its public responsibilities to the region—

1. New starts on recommended multipurpose Columbia Basin power projects in fiscal year 1952 are imperative if present power deficits in the region are not to continue indefinitely. Key projects in meeting future power needs recommended by the Corps of Engineers and Bureau of Reclamation, and concurred in by the Columbia Basin Inter-Agency Committee, include Ice Harbor, The Dalles, and Hells Canyon as well as accelerated construction on projects already under way such as McNary, Hungry Horse, Albeni Falls, Chief Joseph, and Dexter dams.

2. A limited amount of steam and gas turbine generating capacity should be authorized for construction on the outer edges of the Government's transmission system in the Pacific Northwest. Such plants would make power available for defense needs and area loads more quickly than any other type of generation of similar size and cost. They would have the added advantages of effecting substantial transmission savings and of having a permanent value for firming up hydro even after new hydro projects are completed.

3. Clarification and revision of Federal fiscal policy by the Congress to permit more flexible and efficient operations of reimbursable public works remains a pressing need. A major step in that direction would be the establishment of a Columbia Basin account which would treat all projects in the Pacific Northwest as a single unit for the purpose of fixing rates and returning costs reimbursable out of power revenues. Enactment of this proposal would provide a more practical and equitable basis for fixing rates and for applying present policies relating to irrigation subsidy.

Southwestern Power Administration

Douglas G. Wright, Administrator

IN ORDER TO CARRY ON the construction program of the Southwestern Power Administration for the fiscal year 1951, Congress appropriated $8,620,000 in cash, of which $5,000,000 were for the liquidation of obligations incurred and previously authorized. In addition, $1,730,000 in contract authority were granted and $760,000 were appropriated to carry on the operation and maintenance program of the Administration.

ENERGY PRODUCTION

Net generation during the fiscal year from the three reservoir projects now in operation, Norfork (Ark.), Denison (between Tex. and Okla.), and Narrows (Ark.) was as follows:

	Kilowatt-hours
Denison	254, 586, 000
Norfork	207, 583, 100
Narrows	29, 388, 410

ENERGY DELIVERIES

Energy sales by Southwestern Power Administration during the fiscal year 1951 amounted to $2,279,759.22. Electric power and energy generated by the hydroelectric facilities under the marketing jurisdiction of the Administration were sold to 12 rural electric cooperatives, four municipalities, and 5 private utility companies.

Sales to municipalities and rural electric cooperatives amounted to $418,006.18, and to private utility companies $1,861,753.04.

POWER CONTRACTS

Arkansas Power & Light Co.

Periodically during the fiscal year, the Government determined the amount of firm power from the Norfork Dam project that was not needed for its other obligations, and sold the excess power and energy to the Arkansas Power & Light Co. on monthly contracts. A contract has now been executed whereby the power and energy will be sold for an 18-month period, beginning July 1, 1951. The contract provides that the Government will sell to the company 4,000,000 kilowatt-hours per month at a rate of delivery not to exceed 20,000 kilowatts, and any additional firm power not needed by the Government for its other obligations, at rate schedule "A." Dump energy will be sold at 1.25 mills per kilowatt-hour. The Government may buy off-peak power and energy from the company and return the same number of kilowatt-hours to the company during on-peak hours the following month. The additional capacity obtained by the company under this arrangement is to be paid for at 70 cents per kilowatt per month.

Southwestern Gas & Electric Co.

The contract executed with this company provides for the sale of the entire output of Narrows Dam for $207,000 per year. The company will redeliver power to the Government up to 5,000 kilowatts of capacity, for which the Government will credit the company at the rate of 60 cents per kilowatt per month and 4 mills per kilowatt-hour. Power redelivered to the Government at the project site is without limitation as to its use. Power delivered at other points on the company's system may be sold by the Government to rural electric cooperatives only. The Government pays the company 1 mill per kilowatt-hour for each kilowatt-hour (up to 1,000,000 kilowatt-hours a month) delivered by company to Government or for Government's account.

Public Service Co. of Oklahoma and Oklahoma Gas & Electric Co.

A contract for the sale and exchange of electric power and energy was executed on July 13, 1950, with the Public Service Co. of Oklahoma and the Oklahoma Gas & Electric Co. The contract became effective on February 6, 1951, when the rates and charges contained in the contract were approved by the Federal Power Commission. Under the terms of the contract, the Government can request the companies to deliver to the Government, or for its account, the electric power and energy required to serve Government's customers in the area of the companies. In return for such power and energy, the Government delivers to the companies 1.65 kilowatts and 330 kilowatt-hours for each kilowatt delivered by companies to Government or for its account. The companies pay Government $1.15 per kilowatt for 0.15 kilowatt of each 1.65 kilowatts delivered by Government to companies. The Government pays the companies 4 mills per kilowatt-hour for all kilowatt-hours which companies deliver to Government in excess of the kilowatt-hours which Government delivers to companies. In addition, the Government pays companies a service charge of 1.25 mills per kilowatt-hour for all kilowatt-hours delivered by companies tc Government.

The contract also provides that the Government can sell excess capacity to the companies at the rate of 4½ cents per kilowatt per day, and excess electric energy at the rate of 1.25 mills per kilowatt-hour.

The contract further provides that the Government can purchase off-peak energy from the Companies at the rate of 3.25 mills per kilowatt-hour.

Contracts With Preferred Customers

Electric service agreements totaling 7,150 kilowatts were executed with five rural electric cooperatives in Oklahoma. These cooperatives receive service through the facilities of the two Oklahoma utility companies in accordance with the terms of the contract between this Administration and Public Service Co. of Oklahoma and the Oklahoma Gas & Electric Co.

Three municipalities in Oklahoma and one in Arkansas contracted during the fiscal year 1951 with Southwestern Power Administration for a total of 1,810 kilowatts to be delivered under the provisions of the Oklahoma contract.

Four municipalities in the State of Missouri have entered into contracts with the Administration for a total of 5,500 kilowatts. These contracts are contingent upon the Government's being able to use the facilities of generating and transmission cooperatives necessary for the delivery of power to the municipalities.

During the fiscal year 1951, a contract was entered into with KAMO Electric Cooperative, a generating and transmission cooperative, calling for the ultimate delivery of 55,000 kilowatts to the cooperative. A second agreement was entered into with KAMO Electric Cooperative which will enable this Administration to lease the transmission facilities that are to be constructed by the cooperative.

Three contracts have been entered into with the M. & A. Electric Power Cooperative. One of these contracts is a temporary agreement calling for the delivery of 450 kilowatts at Doniphan, Mo. The second contract covers the sale of 2,500 kilowatts and calls for delivery by the Government to the cooperative at Idalia, Mo. This contract further provides, upon payment of a service charge of 1.25 mills per kilowatt-hour, that the Government can use the facilities of the cooperative to deliver power and energy to other customers of the Government. This contract covers only the present facilities of the cooperative. The third contract is a provisional contract and is contingent upon the cooperative's completion of its planned system. This contract calls for an ultimate delivery of 27,500 kilowatts and would replace the first two mentioned contracts. This contract also permits the Governnent to use the facilities of the cooperative for the delivery of power o Government's other customers upon payment of service charge to he cooperative.

PERSONNEL

The personnel staff concentrated on establishing and recruiting to fill critical positions in the various operating divisions. Emphasis was placed on the improvement of personnel procedure, employee-utilization program, and wage surveys. The following files were revised and are maintained in accordance with Civil Service requirements: (1) Service control file, (2) chronological file of personnel actions, (3) position description file, (4) retention preference record file, and (5) active and inactive application file.

Southwestern Power Administration has been able to carry on its extensive activities in the six-State area with 290 employees. Nine of the agency's employees are in active service on military furlough.

SUPPLY AND PROCUREMENT

The supply branch continued to improve the supply program by establishing warehouse stock levels, forecasting long-range requirements, and scheduling procurement accordingly. Established quarterly quotas for critical and programed material, and obtained priorities to assure delivery at all times to meet demands. Property control and accountability records have been established and are current at all times.

Southwestern Power Administration has been concerned with significant litigation during the fiscal year 1951 as follows:

LITIGATION

United States v. *Arkansas Power & Light Company*, an action for damages for breach of contract arising out of the energy sales agreement between the Government and the company which is now pending for final trial.

Kansas City Power & Light Co. et al. v. *Oscar L. Chapman, Secretary of the Interior et al.*, Civil No. 4276–50, United States District Court, District of Columbia. This is a suit instituted by the Kansas City Power & Light Co. and nine other public utilities in the southwestern area against the Secretaries of the Treasury, Agriculture, and Interior, the Administrators of Rural Electrification Administration and Southwestern Power Administration, for injunctive and declaratory relief primarily to enjoin the defendants from advancing, transmitting, lending, giving, or disbursing monies to certain federated cooperatives, N. W. Electric Power Cooperative and Central

Electric Power Cooperative and Sho-Me Power Corp., for the construction of any of the electric facilities or in furtherance of any of the projects described in the complaint. Motion to dismiss has been overruled and answers have been filed.

No. 12,095

After the filing of the above-mentioned suit, the Kansas City Power & Light Co., and five other private utility companies listed as plaintiffs in the Washington suit, filed a complaint before the Public Service Commission of Missouri against the N. W. Electric Power Cooperative, and Douglas G. Wright, as Administrator of Southwestern Power Administration, to require the cooperative to obtain a certificate of convenience and necessity for its generation and transmission system in the State of Missouri, and to require Douglas G Wright, as Administrator of Southwestern Power Administration, to comply with the rules and regulations of the Public Service Commission of Missouri with respect to the sale and transmission of electric power and energy in the State of Missouri, which is now pending on motion to dismiss filed by both the cooperative and the Administrator.

SPA SYSTEM

During the fiscal year 1951, one substation, an extension to an existing substation, and approximately 190 miles of transmission lines were added to Southwestern Power Administration's system. This makes a total of four substations, two switching stations, and approximately 700 miles of transmission lines presently being maintained by the Administration. During the 1952 fiscal year, approximately 240 miles of transmission lines (170 miles 154-kilovolt, 40 miles 132-kilovolt and 30 miles of 66-kilovolt), five substations, and four switching stations will be added to Southwestern Power Administration's system One project (Bull Shoals) with 160,000-kilowatt rated capacity is scheduled to go into commercial operation during fiscal 1952.

Muskogee, Okla., continued to be the field operations center, servicing four maintenance-unit depots and with patrol crews stationed a four strategic points.

Contract negotiations with the Government's preference customers public bodies, municipalities, and rural electric cooperatives, will be continued.

Southeastern Power Administration

Ben W. Creim, Administrator

THE SOUTHEASTERN POWER ADMINISTRATION was established by Departmental Order No. 2558, dated March 21, 1950 (15 F. R. 291). This order delegated to the Administrator of the Southeastern Power Administration the authority of the Secretary of Interior under section 5 of the Flood Control Act of 1944 (16 U. S. C., 1946 ed., Sec. 825s) to dispose of electric power and energy generated at reservoir projects under the control of the Department of the Army in the States of West Virginia, Virginia, North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Kentucky, and Tennessee, exclusive of the TVA area.

During the fiscal year 1951 the total installed capacity of hydroelectric plants constructed by the Corps of Engineers from which Southeastern has the responsibility to market power and energy has grown from 110,600 kilowatts to 245,600 kilowatts of installed nameplate capacity.

At the close of fiscal year 1951 three hydroelectric plants were in operation, namely: (1) Allatoona, located on the Etowah River near Cartersville, Ga., with an installed nameplate capacity of 74,000 kilowatts in three units, the power from which is being sold to Georgia Power Co., (2) Dale Hollow, located on Obey River, a tributary of the Cumberland River in northern Tennessee with an installed nameplate capacity to date of 36,600 kilowatts in two main units and one house unit with the third 18,000-kilowatt unit scheduled for future operation, and (3) Center Hill, located on Caney Fork of the Cumberland River in northern Tennessee with an installed nameplate capacity of 135,000 kilowatts, equally in three units. Power from Dale Hollow, Center Hill, and Wolf Creek (first two units scheduled for operation in August 1951) has been sold to the Tennessee Valley Authority.

There are throughout the area seven projects under advanced construction. The generation of this power is scheduled to begin in August 1951. The last unit is scheduled for December 1955. These projects are listed in chronological order.

Project	Basin	Energization of first unit	Total ultimate nameplate capacity in kilowatts
Wolf Creek	Cumberland River, Ky	August 1951	270,00
Philpott	Roanoke River, Va	September 1952	14,00
Buggs Island	do	October 1952	204,00
Clark Hill	Savannah River, Ga.-S. C	do	280,00
Jim Woodruff	Appalachicola River, Fla	December 1953	30,00
Cheatham	Cumberland River, Tenn	January 1954	36,00
Buford	Appalachicola River, Ga	December 1955	86,00
Total			920,00

Of next importance are eight projects in various planning, program, and budget stages. These projects are listed in chronological order.

Project	Basin	Energization of first unit	Total ultimate nameplate capacity in kilowatts
Old Hickory	Cumberland River, Tenn	March 1954	100,000
Carthage	do	April 1955	92,000
Lower Cumberland	Cumberland River, Ky	May 1955	130,000
Celina	Cumberland River, Ky.-Tenn	February 1956	64,800
Gathright	James River, Va	March 1956	34,000
Salem Church	Rappahannock River, Va	July 1956	80,600
Hartwell	Savannah River, Ga.-S. C	December 1956	180,000
Howell Mill Shoals	Coosa River, Ala	do	200,000
Total			881,400

At the close of fiscal year 1951 the Administration had received 120 applications from preference agencies including public bodies, municipals, and cooperatives which reported an aggregate December 1950 peak of 483,000 kilowatts, which is estimated to grow to 700,000 kilowatts by December 1955. The Tennessee Valley Authority has indicated that it can easily absorb within its system all scheduled generation from the Cumberland River Basin hydroelectric plants as this power becomes available.

During fiscal year 1951 memoranda of understanding outlining the basic terms of definitive power sales contracts have been executed with Alabama Electric Cooperative, Inc., and South Carolina Public Service Authority. A contract has also been executed with Greenwood County Electric Power Commission of Greenwood, S. C., for the sale and exchange of power and energy. The above three commitments aggregate 57,500 kilowatts.

During the fiscal year discussions were held with representatives of all the private utility companies in whose service areas are located projects under construction from which power is now being marketed. The Administration proposed in all instances that the Government construct only the backbone transmission lines required to transmit power from the power plants to load centers and proposed that the rivate companies wheel power for the account of the Government rom load centers to preferred agencies which contract with the Govrnment for purchase of power. Only one of the companies expressed willingness to wheel power for the account of the Government and engthy negotiations were undertaken in an attempt to arrive at an greement. No agreement had been reached at the close of the fiscal year in view of the company's insistence that it be paid a fee for transmitting power for the account of the Government which was regarded as excessive by the Administration.

Total revenues of the Administration for fiscal year 1951 were $2,458,469.50, making a total of $3,788,050.57 in power revenues reeived by the Government from projects for which the Administraion is marketing agent.

Bureau of Mines

James Boyd, Director

FOREWORD

AS ARMED CONFLICT in Korea and the threat of ggression elsewhere created a national sense of urgency last year, very activity of the Bureau of Mines was reappraised on the basis f its potential contribution to the defense of the Nation and the free world. This reappraisal was applied to mining and metallurgical research, to studies of mineral fuels and their utilization, to investigations of explosives and explosions, to the many-faceted program designed to minimize human suffering and loss of facilities due to accidents in the mineral industries, and to the collection and analysis of economic and statistical data on all phases of mineral production, supply, and consumption.

The two great wars since creation of the Bureau 41 years ago not only demonstrated the importance of minerals and mineral fuels to military success but also seriously depleted the Nation's mineral reserves. A survey of America's position with respect to the principal industrial minerals revealed that in some 17 metals and minerals—including such key commodities as copper, lead, zinc, mercury, bauxite, and iron ore—the Nation's production in relation to domestic consumption has declined compared with the war years 1940–44 or with the prewar years. In only five minerals has our position improved.

Ever since VJ-day the Bureau has been striving to help bridge the widening gap between supply and demand by searching for additional deposits, by studies designed to make submarginal mineral deposits commercial, by development of alternate materials, and by experimentation aimed at more complete recovery and utilization of the mineral values in complex and refractory ores. The growing emergency demanded greater intensification of effort rather than its redirection.

Some shifts of emphasis were, of course, inevitable. In scientific and technologic research, priority had to be given to the strategic and critical metals and nonmetallic minerals, to petroleum products (natural and synthetic), and to coking coal. Economic and statistical studies were influenced increasingly by requirements stemming from accelerated military preparedness and the foreign military assistance program, and by the need for timely, accurate data upon which decisions relating to imports, allocation controls, and other regulatory measures of Government could be made promptly and equitably. About midyear, creation in the Department of the Interior of the Defense Minerals Administration, the Defense Solid Fuels Administration, and the Petroleum Administration for Defense imposed new responsibilities upon the Bureau of Mines. These agencies looked increasingly to the Bureau for economic data and technical advice as a basis for formulating and carrying out programs to assure adequate supplies of minerals and mineral fuels for defense requirements and essential civilian needs.

As the year progressed, the Bureau concentrated more and more upon problems of immediate urgency, slowing or recessing projects that are definitely long range. Efforts to increase the domestic supply of manganese, for example, resulted in marked progress. On the basis of small-scale experiments, the technical feasibility of extracting manganese from open-hearth steel-furnace slags was established, and efforts to make the process economic were prosecuted vigorously in cooperation with the iron and steel industry. Attacking the manganese problem on another front, the Bureau made more headway toward developing economic methods of mining and utilizing low-grade domestic ores during fiscal 1951 than in all its previous history. This goal has not yet been attained; but it is now definitely in sight, and efforts to reach it will be intensified during the coming year, when a pilot plant at Boulder City, Nev., begun last year, is expected to go into operation. Exploration and development, meanwhile, added substantially to known domestic manganese reserves.

Other problems concerning ferrous metals likewise received much attention, including those presented by the advanced depletion of the Mesabi range, currently the Nation's principal source of direct-shipping, open-pit iron ore. The Bureau made a study of the proposed St. Lawrence Seaway in connection with economical movement of Labrador iron ore to the Great Lakes steel-making centers. It also continued investigations into the problems expected to arise as greater reliance has to be placed upon iron ore that is extracted from deep mines instead of by open-pit operations and that which must be concentrated before shipment to the blast furnaces.

The Bureau also moved to increase the Nation's ability to produce important ferro-alloy metals, such as chromium, nickel, and cobalt, as well as tungsten and molybdenum, for which demand exceeded supply during the year. The Bureau's process for producing pure chromium lectrolytically from low-grade concentrates advanced so far that a ommercial plant now under construction will use it. The technical feasibility of extracting nickel from a low-grade ore reserve in Oregon was established, but more research is required to make the process conomic.

Routine Bureau mineral-exploration projects during the year outined additional reserves of copper, lead-zinc, antimony, and mercury ores of commercial or near-commercial size and grade. At the request of the Atomic Energy Commission, the Bureau doubled its facilities for producing pure zirconium metal. It also continued tests on the beneficiation of submarginal domestic bauxites in the hope of developng a technically and economically feasible process of upgrading them for use in aluminum production. Moreover, the Bureau obtained additional information on the physical properties of ductile titanium and its alloys.

The Bureau's studies of strategic and critical nonmetallic minerals were intensified during the year. As the world demand for sulfur soared beyond the productive capacity of the dome deposits, special attention was given to the technology and economics of obtaining this mineral as a byproduct and from sources ordinarily wasted. Mining and ore-dressing studies of the pegmatites—coarse mineralized rocks containing mica, beryl, and other minerals important to defense—were pushed. Progress was made in producing such strategic minerals as mica and asbestos synthetically, and research was conducted upon building up talc block from talc powder to reduce the shortage of the commodity.

Motivated by concern over depletion of the Nation's best coking coals, the Munitions Board a few years ago requested the Bureau to take an inventory of known minable reserves. This project was prosecuted vigorously during the year in the Appalachian field, upon which the steel industry now relies most heavily, and will continue until every source of coking coal in the Nation has been covered. As the steel industry requires coke meeting rather rigid specifications as to strength and chemical composition, the survey involves not only estimating known minable reserves but also investigating the carbonizing properties of the various coals and methods by which the content of ash, sulfur, and other impurities can be reduced to a point tolerated for metallurgical use. Reports on several counties were issued during the year, and surveys either have been completed or are in progress in a number of others in Pennsylvania, West Virginia, Kentucky, Colorado, and New Mexico.

Studies directed toward wider utilization of extensive western deposits of lignite and subbituminous coal also were emphasized. These low-rank coals comprise about two-thirds of the Nation's known coal reserves on a tonnage basis but in the past have provided only a minor share of its solid fuels production. Completion of the Bureau's Lignite Research Laboratory at Grand Forks, N. Dak., only one of its kind in the United States, paved the way for research expected to increase the usefulness of this locally abundant fuel tremendously.

In east central Pennsylvania, meanwhile, the Bureau worked to develop a system of mechanical mining that would reduce the loss of anthracite under present practices. To aid in this and other technical studies of the problems of the anthracite industry, addition of a new wing to the Anthracite Research Laboratory at Schuylkill Haven, Pa., was begun. Anthracite is being considered seriously as fuel for a new type of furnace expected to be used for recovering manganese from open-hearth slags.

Increasing demands for liquid fuels and lubricants, both military and civilian, emphasized the importance of the Bureau's technologic research designed to conserve the Nation's petroleum resources by increasing ultimate recovery and to reduce the cost of producing liquid fuels synthetically from both coal and oil shale. These efforts were being accelerated at the close of the fiscal year, when the possibility arose that a substantial part of the oil production of the Middle East might be lost to the western world.

The development of processes for producing liquid fuels by the hydrogenation of coal at Louisiana, Mo., and from oil shale at Rifle, Colo., progressed to the point where the Secretary of the Interior, about midyear, recommended the establishment of a few commercial plants by private industry, with such Government assistance as is available under existing legislation. Although it still costs a little more to produce gasoline, Diesel fuel, and kindred products from coal or oil shale than from natural petroleum, this gap is narrowing rapidly, and the demand for the byproduct chemicals is so great that such plants should become attractive investments.

Thousands of gallons of gasoline produced by coal hydrogenation were tested in military equipment to the satisfaction of the authorities concerned. The great flexibility of plants of this type was demonstrated; they are capable of turning out large quantities of the products most in demand at a given time, whether aviation gasoline or Diesel and fuel oils, as well as important chemicals. Successful use of an iron catalyst eliminated the need for those that contain such strategic metals as cobalt, nickel, tin, chromium, and molybdenum.

The other coal-to-oil demonstration plant at Louisiana, which will use the gas-synthesis process, was completed during the year, and its various units were put through preliminary tests. This plant is the first of its kind to be erected in the United States. Its operation, coupled with laboratory research at Bruceton, Pa., and Morgantown, W. Va., is expected to provide data for establishing the technical and economic adaptability of this process to American coals.

In the Bureau's work on oil shale at Rifle, Colo., the year's most significant development was successful testing of a pilot-plant-size gas-combustion retort, which not only operates continuously but requires no cooling water and uses part of the gas it produces to provide heat for the process. Elimination of the need for water is especially important because the Nation's principal oil-shale reserves are in semiarid country. The most dramatic event of the year, as far as shale-oil development is concerned, probably was the use of Diesel fuel made at Rifle to power the Denver & Rio Grande Western Railroad's passenger train, the Prospector, on a regular run from Salt Lake City to Denver.

Less spectacular, but equally significant in its contribution to the sustained military and economic strength of the Nation, was continuation of scientific and technologic research on the recovery and refining of natural petroleum. The Bureau pioneered in petroleum-engineering research years ago. Its studies, coordinated with the investigations of industry and private laboratories and research foundations to supplement rather than duplicate them, have been instrumental in increasing substantially the recoverable portion of the Nation's oil reserves. During the year the Bureau made engineering studies of a number of oil fields, completed analyses of more than 200 crude oils from new and important fields in this country and abroad, and carried on other technical studies in cooperation with industry.

Helium, of which the Bureau of Mines is the sole producer, was in greater demand by Federal agencies and private industry and institutions than at any time since 1945; in fact, it became necessary to operate two plants most of the year. The demand for grade A helium of 99.995 percent purity rose, and capacity for producing it was increased accordingly. The demand for high-purity helium for welding and metallurgical use is expected to be intensified as production of defense matériel advances, and medical use of this inert gas is becoming more extensive.

The Bureau is the only civilian agency of the Government that studies explosives and the explosion hazards of industrial fumes and dusts. During the year, it sought more efficient and safe materials for stemming charges of permissible explosives and made gains in basic research to determine exactly how firedamp is ignited by explosives, promising more effective precautions against coal-mine explosions. The Bureau also progressed in ascertaining the explosive characteristics of industrial dusts and in developing effective measures for preventing dust explosions and minimizing their severity if they occur. A number of studies were made for the Armed Services.

An upward trend in coal-mine fatalities during the first 4 months of the calendar year 1951, high-lighted by two major disasters, emphasized the fact that unremitting vigilance is the price of mine and plant safety. The first disaster, a gas explosion in a bituminous-coal mine, occurred in January. Taking 11 lives, it ended a disaster-free period of nearly 26 months beginning in November 1948—the longest in the statistical history of American coal mining. The other disaster, also an explosion, occurred in an anthracite mine in March and killed five persons.

Except for January–April 1951, the fatality rate during the fiscal year trended downward, reflecting in part a concerted and determined effort by management, labor, State mining agencies, and the Bureau of Mines. These efforts have been intensified, but it will be surprising if the fatality rate for the calendar year 1951 is brought down to that of 1950 or 1949 during the 6 months to come. In June, the fatality rate decreased to 0.85 death per million man-hours, reducing the monthly average for the first 6 months of the year to 0.95 compared with the annual rates of 0.90 in 1950 and 0.91 in 1949.

The Bureau's work during the fiscal year provided basic information that will be useful to all who are striving to reduce the accident toll in the mining and allied industries. The intensive attack upon the prevention of falls of roof and coal or ore, the No. 1 killer in the mining industry, continued, with special emphasis upon roof bolting. This involved field investigations and laboratory research. The lessons learned are being made available to supervisors and miners through special classes on roof-control methods as well as through Bureau publications. A similar campaign looking toward increasing haulage safety was carried on during the year.

The policy of investigating all fatal accidents in coal mines, begun during the previous year, was followed, and analyses of all roof-fall and haulage fatalities in bituminous-coal mines and of all fatalities in anthracite mines from February through December 1950 were made available in separate publications. More information about the precise circumstances under which fatalities occur was obtained, and this is being utilized to improve the Bureau's programs of safety education and training.

On May 8 the Bureau issued its first approval of a Diesel locomotive as permissible for safe use in coal mines, representing culmination of about 20 years of study of the use of Diesel equipment underground. Several years earlier the Bureau had set up a permissibility schedule more rigorous than those employed in countries where this type of equipment has been standard for many years because the use of trolley locomotives is not tolerated. It was not until last year, however, that an American manufacturer produced a locomotive that met the Bureau's standards. The Bureau stands ready to study and watch the operation of such locomotives underground under actual operating conditions, and will if necessary make further recommendations to insure operation that will protect the mine personnel.

Education and training, on which the Bureau has relied heavily during its 41 years of efforts to promote safety and health in the mineral industries, were carried on throughout the year on an expanded scale. Special courses were conducted on accident prevention for coal-mine supervisors, coal miners, and metal-mine officials and employees, as well as supervisors and workmen in the petroleum industries. An accident-prevention course for employees of mills, ore-dressing plants, and smelters was prepared during the year and is to be tested soon. First-aid and mine rescue training was continued, and for the first time since 1931 a national first-aid and mine rescue contest was planned, to be given in the fiscal year 1952. Several State mining departments, coal- and metal-mine trade associations, and mine workers' organizations joined the Bureau in sponsoring this contest.

Under authority of the Coal-Mine Inspection Act of 1941, the Bureau's inspectors made 9,000 inspections of about 5,000 coal mines, visiting some of them more than once. Although the Bureau has no enforcement authority, publication of the results of these inspections, supplemented by letters to the heads of mining companies and of State mining departments calling attention to serious hazards, resulted in a notable number of corrective actions.

The past fiscal year was the third during which the Bureau had funds available for combatting fires in coal deposits not now being mined. Seven fires were extinguished or brought under control, raising to 19 the number that have been or are in process of being attacked. It is estimated that 100,000,000 tons of coal reserves have been saved by this program. This work is expected to be continued.

Another measure for conserving an irreplaceable natural resource on which the Bureau progressed during the year is the control of underground and surface flood waters that threaten to abridge the life of the Pennsylvania anthracite industry. The study of practicable methods for controlling the flood waters has reached the point where it is expected that a report, containing recommendations for action, will be ready to submit to the Congress late in the fiscal year 1952 or early in the fiscal year 1953.

With a view to improving its statistical program, the Bureau during the year contracted with the American Statistical Association for a thoroughgoing study and recommendations, expected to be completed by the close of the 1952 fiscal year. In the newly established office of the chief economist, research was begun on mineral taxation and tariffs, and in cooperation with the Air Force and the Bureau of the Budget, basic research was started on the relationships between broad economic trends and requirements for mineral raw materials and mineral fuels. The Bureau assisted in the trade negotiations at Torquay, England, and in the work of the President's Materials Policy Commission.

MINERAL DEVELOPMENT

Bureau of Mines work on metallic and nonmetallic minerals in 1951 was keyed to the needs of the military establishment and the even greater requirements of the industrial mobilization program. At the same time, the Bureau did not overlook the need for accelerating its mineral resource-development programs to assure adequate raw materials for a protracted period of partial mobilization, for full mobilization if it should become necessary, and for replenishing reserves being depleted at abnormally high rates.

Establishment of the Defense Minerals Administration added to the Bureau's duties. It assigned mining engineers and metallurgists to field teams to investigate projects for which DMA assistance was sought. Many prospects and mines were examined and ores metallurgically tested to determine the feasibility of proposed ventures. By the end of the year, liaison between the two agencies was smooth and efficient, and DMA could rely upon the Bureau's technical and statistical services for advice in programming and passing upon applications in Washington and for examinations in the field.

By the end of the year, 12 encyclopedic reports on strategic and critical minerals were nearing completion, and plans were perfected for preparing some 30 others. These are to be a part of a series of materials surveys for the National Security Resources Board.

The Bureau's fact-finding and advisory services grew in number, scope, and urgency. The stockpiling program of the Munitions Board, on many of whose committees the Bureau is represented, continued to make heavy demands. In addition, technical investigations were made for the Emergency Procurement Service regarding the procurement of mineral commodities, the beneficiation of low-grade stocks, and the improvement of stockpile storage procedures.

The Leadville, Colo., drainage tunnel, expected to free large reserves of lead-zinc and manganiferous ores now flooded, advanced some 3,000 feet during the year. By year end, the water level in some of the mines had fallen considerably. In anticipation of completion of the tunnel, mining operations in the area were being planned by private enterprise.

Field staffs of the Bureau engaged in investigations related to various river-basin programs. By the end of the year, data on more han 500 properties had been entered in an atlas of the mines and mineral deposits of the Black Hills, S. Dak. Reports were prepared on high-swelling bentonite resources of Wyoming, South Dakota, and Montana; on the mineral resources of the Big Horn Basin in Wyoming and Montana; on Wyoming iron-ore resources; and on the vermiculite deposits of the Encampment area in Wyoming. A survey of mines and mineral deposits in Jefferson County, Mont., was carried ahead early in the year. County-by-county surveys were made of Kansas mineral resources in the Missouri and the Arkansas-White-Red River Basins.

Two more drill-core storage houses were put into service. One of them already has received many drill cores from State- and railroad-owned lands, as well as smaller contributions from private mining companies. Some 300,000 feet of drill core from the World War II Arkansas bauxite investigation has been moved from rented space at Little Rock to a Government core-storage house at Bauxite, Ark.

To provide industry and Government with information needed for defense mobilization, the Bureau expanded its statistical activities considerably during the year. Canvasses were converted from partial to complete coverage and were made more frequently. Data on production, consumption, and stocks were released at the earliest practicable dates. Progress in decentralizing the collection of mine-production statistics continued throughout the year.

Several staff members participated in the work of the International Materials Conference, seeking a practicable basis for the international allocation of strategic and critical minerals.

Ferrous Metals

A reevaluation of domestic iron-ore reserves revealed ample supplies for current needs in all steel-producing districts. However, it showed that production from the Mesabi range, the major source of supply, would begin to decline within a few years. Future domestic production will depend increasingly upon leaner ores requiring beneficiation and upon underground mines, resulting in higher costs, lower productive capacities, and decreased flexibility. The importance of the St. Lawrence Seaway project in bringing newly developed Quebec-Labrador iron ore to Great Lakes consuming areas was studied.

The Bureau accomplished much to make available new sources of manganese to meet the requirements of expanded steel production. Special appropriations permitted the construction of a pilot plant at Pittsburgh for extracting manganese from open-hearth steel-furnace slags, heretofore a waste product. Establishing the validity of former laboratory research, operation of this plant gave promise that the process may be a commercial success, and, if so, it could supply nearly half of the Nation's current manganese requirements. The Bureau also began construction of a pilot plant at Boulder City, Nev., to determine the feasibility of processes developed on a laboratory scale for extracting manganese from low-grade domestic ores. Some progress was made in studies looking toward conservation of manganese in use. In addition, many millions of tons of low-grade ores were added to known domestic resources of this critical ferro-alloy by exploration and development of new reserves, which were expanded during the year.

During the year development, maintenance, and experimental mining of chromite deposits in Stillwater County, Mont., were discontinued. However, laboratory studies aimed at upgrading the ore for metallurgical use proceeded. The specification of a hard, lumpy material presents a difficult problem. The Bureau has produced pure chromium metal from low-grade chromite concentrates electrolytically, and the process has been developed to the point where it will be used in a commercial plant now being built.

In southwestern Oregon, extensive soil-sampling tests were made to increase the known tonnage of low-grade nickel ore at Riddle Mountain. Four partial-reduction smelting heats on Riddle ore recovered 78 to 91 percent of the nickel, but an economic process has not yet been developed.

The demand for tungsten and molybdenum exceeded the supply. The Bureau cooperated with DMA and many other Government agencies in efforts to increase production of these metals, supplying data on which several programs are based. Field investigations were made at many deposits, one of which has been drilled, and metallurgical tests were made on ore from several mines.

Nonferrous Metals

Twelve copper, lead-zinc, antimony, and mercury deposits were investigated during the year, several of them establishing ore reserves of commercial or near-commercial size and grade. Two projects dealt with the large zinc-lead districts of the Mississippi Valley, one in Missouri, Oklahoma, and Kansas and the other in Illinois, Wisconsin, and Iowa. With the cooperation of State agencies and private mining companies, drill logs and other exploratory and mining records were compiled in each of these districts and made readily available.

Supplies of and requirements for copper, lead, zinc, and mercury were estimated, and tentative programs for increasing supplies were prepared early in the year; after DMA was created, these were elaborated, revised, and added to its program. In the field and in Washington, reports were prepared on the potential production of individual copper, lead, and zinc mines, together with data on milling capacities and on factors that might restrict further expansion.

Data sheets on copper, lead, zinc, cadmium, antimony, and tin were prepared for use of the State Department in conferences with representatives of the United Kingdom Ministry of Supply. Bureau staff members attended these conferences as technical advisers and observers. Recommendations regarding tariff action on metals and metal products also were prepared for the Torquay, England, conference.

Throughout the year a continuing project was carried on looking to the development of a caustic leaching-electrolytic process for treating zinc ores not amenable to conventional ore-dressing methods. Progress was made on purification of solutions before electrolysis.

At the request of the State Department, investigations were continued on a sulfidizing-volatilization process for treating low-grade Bolivian tin ores.

With funds provided by the Atomic Energy Commission, the Bureau studied radioactive minerals during the year. This involved field investigation of numerous deposits and laboratory research on methods of analysis, concentration, and extraction. By arrangement with the AEC, too, the Bureau helped to test and evaluate about 9,000 samples of ore believed to contain uranium. This contributed to increased interest in prospecting for radioactive minerals and has led to the discovery of potentially valuable deposits.

At the request of the Atomic Energy Commission, the Bureau doubled its facilities for producing pure zirconium metal by the magnesium-reduction process. This has permitted more effective research on process improvements and on the properties of zirconium and its alloys. It has provided metal for testing by numerous private companies.

The Bureau was represented on the Interagency Committee on Beryl and Monazite which has helped draft programs to expand supplies of these commodities. Domestic sources of monazite and bastnaesite recently explored by Government and private agencies promise to make the United States self-sufficient in rare earths within 2 years. Experiments pointed to the feasibility of concentrating fine-grained, low-grade beryl ores; and this process, if it can be developed to the production stage, will more than treble the potential domestic supply of beryl.

Laboratory work on four high-iron bauxites, reported during the year, developed methods for treating this material to produce a nonmagnetic product meeting chemical requirements for abrasive bauxite and a magnetic product suitable for Bayer-plant feed, with substantially complete recovery of the contained aluminum. Search for methods for desilicating high-silicon bauxites to make them suitable for Bayer processing continued.

Government-owned ferrosilicon-process magnesium plants have been reactivated to help supply defense requirements. Bureau laboratory experiments suggested the possibility of lowering production costs by developing a continuous reactor to operate under a helium atmosphere at atmospheric pressure. A 50-kilvolt-ampere reactor was constructed and initial tests were made. The fabrication and physical properties of new magnesium alloys in which lithium and aluminum are used instead of more critical metals are being investigated.

The titanium pilot plant at Boulder City, Nev., is being operated, under Bureau supervision, by the Titanium Metals Corp. of America under a cooperative agreement effective in November 1950, and output has been increased from about 200 pounds of sponge a week to roughly 1,500 pounds. The cooperating company fabricates the metal and makes it available to Government agencies for research and development. Other titanium research led to the design of an improved arc-melting furnace, improvements in the mechanical properties and surface appearance of rolled titanium sheet produced from powder compacts, and additional information on the physical properties of titanium and its alloys. A method for reducing titanic chloride by magnesium in a continuous process is being sought.

Nonmetallic Minerals

The Bureau of Mines expanded its work on sulfur during the year to meet growing requirements for this commodity. Surveys were begun on the availability of sulfur as a byproduct, and exploration of sulfur-mineral deposits now considered marginal was expanded. Drilling was done on a Minnesota pyrite deposit.

As it continued difficult to obtain kyanite of high refractory grade from abroad, the Bureau conducted extensive research on mullite refractories made both from natural kyanite and by synthesis from other more abundant minerals. This showed that synthetic kyanite produced in this country probably would be a satisfactory substitute for the foreign material but would cost more.

The Bureau continued to study building materials along the Alaska Railroad, as well as to make field and laboratory investigations of pegmatite deposits. Emphasis was placed upon more efficient mining, recovery, and utilization of the pegmatites—potential sources of mica, beryl, and other minerals important to defense.

Progress was made in mineral synthesis, particularly in melting and crystallizing synthetic mica. Methods of forming large crystals suitable for producing strategic mica were emphasized, and further work was done on hot-pressed synthetic mica. Research also was conducted on synthetic asbestos, as well as on the beneficiation of natural asbestos. Deposits of this mineral in California and Arizona were examined.

Research continued on hard carbides needed in the abrasives industry.

Miscellaneous Research on Minerals

The application of physical science to the solution of mining problems continued throughout the year. Microseismic recording instruments were used successfully in several iron-ore mines where subsidence is a serious problem. Blasting research was conducted along several lines. The so-called linear array of recording gages, sealed-in lines of drill holes along the path of a shock wave caused by the detonation of a charge of explosives, was used in an investigation of oil-well shooting for comparing types of explosives, loading designs, and other variables. It was employed also at the Experimental Oil-Shale mine of the Bureau at Rifle, Colo., in investigating millisecond-delay blasting and during a study of quarry blasting in Georgia. Other blasting studies were carried out at a Corps of Engineers dam site to determine whether contractors were complying with certain specifications designed to prevent damage to concrete structures.

A study at the Mount Weather, Va., Experimental Hard-Rock mine on crystallographic orientation of diamonds in drill bits led to a preliminary conclusion that diamond wear might be reduced substantially without undue cost by setting the stones in certain "hard" directions. This study will be continued. A university fellowship was established to permit a graduate mining-engineering student to work on diamond-drilling research under the guidance of Bureau engineers. The first year's study dealt with the cutting action of the diamond bit.

Voluminous technical reports and other records of mineral investigations by Government agencies—accumulated, filed, and indexed at Mount Weather—were drawn upon in appraising production and exploration projects for which applications for assistance had been filed with DMA.

The measurement and correlation of thermodynamic properties of metallurgical substances are being continued. These data are invaluable, not only in formulating new metallurgical processes but also in evaluating and improving established ones. They are used by research institutions and private companies all over the world. During the year four papers containing thermodynamic data on ceramic materials, zirconium compounds, and metal sulfides, prepared by Bureau metallurgists were published in the Journal of the American Chemical Society. Fundamental research on the application of fluidization roasting techniques and on improved flotation agents and methods is in progress. Investigations of new methods of determining the components of mineral and metallic substances by petrographic, spectrographic, polarigraphic, X-ray, and chemical means have resulted in the development of faster and more accurate analytical procedures.

FUELS AND EXPLOSIVES RESEARCH

Although total fuel supplies remained adequate last year in spite of growing defense demands, special-purpose fuels presented many problems. Accordingly the Bureau's fuel-research activities emphasized measures to assure the development of reserves and supplies of such fuels—coking coal, and liquid fuels produced not only from natural petroleum but also from coal and oil shale—without sacrificing safety, efficiency, or conservation.

COAL AND COAL PRODUCTS

Coal Mining and Investigations

In the investigation of known minable reserves of coking coal, data were obtained on Armstrong, Westmoreland, and Fayette Counties, Pa., and Floyd County, Ky., and the survey is continuing in 26 other Pennsylvania, West Virginia, Kentucky, Maryland, and Virginia counties. Diamond drilling outlined more than 65 million tons of recoverable coking-coal reserves in thick beds and considerably more in thin beds in the Castleman Basin in Maryland and the Deep River coal field in North Carolina. An estimated minable reserve of 121 million tons was disclosed in Gunnison County, Colo.

The Bureau completed studies of pillar extraction with mechanical equipment in 13 bituminous-coal mines in West Virginia and Kentucky and of the performance of mechanical loaders in 16 West Virginia and Pennsylvania mines where pillars are not recovered. New, highly productive methods of mining in thick, steeply pitching anthracite beds were demonstrated, as was the versatility of lightweight cutting and shearing machines for use under widely varying conditions in the anthracite region.

Coal Preparation

Determination of the amenability of known coking reserves to preparation that will meet metallurgical standards is nearly completed for the important Pennsylvania coal-producing counties. Reports on the preparation characteristics of coals from Cambria, Indiana, and Armstrong Counties, published during the year, show that sulfur removal is the principal problem.

During the year, the third and largest commercial coal-cleaning plant using the kerosine-flotation process developed by Bureau engineers was installed at an Alabama mine. It has eliminated a major waste problem at this mine, while yielding a better coking coal. Improved design and methods of operation of the cyclone washer permitted coal and refuse to be separated at efficiencies formerly considered unattainable.

Coking, Gasification, Drying, and Combustion Studies

Carbonization tests showed that coal from the extensive Sewall bed in West Virginia can be used for producing good coke if blended with small amounts of high-volatile coal. Carbonization tests of other Pennsylvania, West Virginia, Tennessee, and Alabama coals showed that many of them could be used alone while others must be used in blends to improve various coke qualities.

The Bureau studied the production of char for generation of power and production of coal chemicals by using a fluidized-bed technique to carbonize low-rank western coals and Texas lignite. Two additional tests, involving continuous operation of the annular-retort lignite gasifier at Grand Forks, N. Dak., showed that this system has possibilities for gasifying lignite and other noncoking coals to produce gas for industrial or domestic use or as a chemical raw material.

Research Facilities

The Lignite Research Laboratory at Grand Forks, N. Dak., was completed and occupied during the year. Construction of another wing, expected to be completed late in 1951, was begun at the Anthracite Research Laboratory at Schuylkill Haven, Pa.

Services to Government

Accelerated defense activities brought greater demand for the fuel advisory services that the Bureau renders to other Government agencies. Surveys and tests were made to improve the efficiency of fuel-burning equipment of all types. Thirty-eight different Federal agencies were assisted on 195 special problems. Tipple and special samples were taken at 555 coal mines in connection with Federal coal purchasing and for the Bureau's research work, and the personnel of several Federal plants was trained in coal sampling. In all, 10,876 new analyses of coal were reported during the year.

More than 9,700 samples of boiler water used at Federal plants were analyzed and recommendations for treatment made. Illustrative of the savings brought about were $10,000 a year for chemicals at one plant, a decrease of $20,000 a year in maintenance costs at another, and $10,000 in the initial cost for water-treatment equipment at a third. Research on the fundamental causes of boiler corrosion included a search for the most economical compounds for use under various conditions and the development of a number of new analytical methods.

Coal Economics

During the year the Bureau stepped up the collection of statistical and economic data on the production and utilization of coal, coke, coal chemicals, peat, and packaged fuels. Besides being useful to the whole economy, these data formed a basis for the development of programs by the Defense Solid Fuels Administration. The Bureau analyzed not only trends in the production and consumption of solid fuels but also changes in fuel-use patterns and their causes.

Data for forecasting requirements of solid fuels were developed. Among items considered were requirements for and the availability of coal and coke for expanded steel production, information on the replacement, installation, and operation of coke ovens, and requirements of the solid fuels industries for scarce materials for machinery and for maintenance, repair, and operating supplies, as well as applications by the industry for accelerated tax amortization and for Government loans for new production facilities.

SYNTHETIC LIQUID FUELS

Private interest in establishing a domestic synthetic liquid fuels industry increased last year as the Bureau and industry continued to improve equipment and techniques for producing gasoline and other commodities from coal and oil shale. With the technical feasibility demonstrated, industry and Government turned their attention to costs.

Oil From Coal

Improved results in producing synthetic liquid fuels by coal hydrogenation were obtained at the coal-to-oil demonstration plant at Louisiana, Mo. In the sixth liquid-phase run, lasting 2 months, 2,600 tons of Kentucky coal were converted to 336,000 gallons of synthetic oil for vapor-phase processing to high-octane gasoline. Five runs on 3,000 tons of Wyoming coal yielded 300,000 gallons of charging stock. In a month-long vapor-phase run, 78-octane gasoline was produced, and thousands of gallons were tested by the military establishment with "eminently satisfactory" results. An iron catalyst was used successfully in place of those containing such strategic metals as cobalt, nickel, tin, chromium, and molybdenum. The versatility of coal-hydrogenation plants was demonstrated further.

Units of the newly completed gas-synthesis demonstration plant at Louisiana received preliminary tests. Integrated operations to convert coal first to synthesis gas and then to liquid fuels are about to begin as this is being written. The first of its kind in this country, this plant includes a ton-per-hour oxygen-production unit, a gasification unit, a synthesis-gas-purification unit, and product-recovery and refinery facilities.

Laboratory and pilot-plant research at Bruceton, Pa., was concentrated upon improved gas synthesis, direct high- and low-pressure hydrogenation, catalyst improvement, and bench-scale experiments on a new low-pressure, fluidized-bed, coal-hydrogenation process. Long, satisfactory runs were made with a "moving-catalyst-bed" process that eliminated cementation problems and resulted in other improvements. Encouraging test results led to pilot-plant-scale development of the fluidized-bed or dry-coal hydrogenation process, which compares favorably with liquid-phase hydrogenation.

Pilot-plant experiments in the synthesis-gas laboratories at Morgantown, W. Va., resulted in a relatively simple continuous, slag-tapping, gasification process that promises to reduce the cost of synthesis gas. Good-quality synthesis gas, the largest single cost item in the gas-synthesis process, was produced in a pilot plant by gasifying coal with superheated steam and oxygen at atmospheric pressure.

At Gorgas, Ala., gas generated by burning unmined coal was used to run a gas turbine as part of the second field-scale underground gasification experiment of the Bureau and the Alabama Power Co. This had never been done before in this country. As the year ended, preliminary work was under way to test a technique in which high-voltage electricity passed through the coal bed carbonizes the coal and opens passageways for admitting air or oxygen blasts without the need for underground work.

Oil From Oil Shale

Revised estimates of Colorado oil-shale reserves last year raised the total shale-oil potential to nearly 500 billion barrels, of which 80 billion barrels is considered recoverable from the rich Mahogany ledge of the Green River formation. Improved mining techniques, including longer-life drill rods and more efficient blasting, further lowered mining costs in the Experimental mine near Rifle, Colo.

In the oil-shale demonstration plant, an improved, continuous, vertical retort successfully passed pilot-plant tests. It requires no cooling water and uses part of the gas produced to supply heat for the process. For the first time in America, a passenger train was powered with shale-oil Diesel fuel. Shale-oil gasoline and Diesel fuel produced by conventional petroleum-refining techniques have been used successfully for more than a year to power Bureau equipment at Rifle.

Bench-scale experiments at the Oil-Shale Experiment Station at Laramie, Wyo., showed that oil-shale fines would yield when retorted completely refined, marketable products, including benzene, essential for making synthetic rubber, plastics, nylon, and insecticides. Other scarce and useful chemicals could be produced as byproducts. Satisfactory reduction of the sulfur and nitrogen contents in Diesel and jet fuels, enabling them to meet military specifications, was approached.

PETROLEUM AND NATURAL GAS

During the year the Bureau signed an agreement with the Petroleum Administration for Defense providing for the expansion of statistics on production, manufacture, transportation, and consumption of petroleum, natural gas, natural gasoline, carbon black, jet fuels, and aviation gasoline and its components; engineering studies of producing fields, refining methods, and equipment; laboratory research on minor components of crude oils and on the thermodynamics of hydrocarbons, and such other related problems as may be approved by the Bureau of the Budget.

In January 1951 the Bureau of Mines and the Geological Survey undertook a geologic and engineering study of the Canyon Reef fields in Texas at the suggestion of the PAD. Important engineering studies of Colorado, Oklahoma, Montana, and Wyoming oil fields were completed. Research on secondary recovery of oil was emphasized. The Bureau completed analyses of 246 crude oils from new and important domestic and foreign fields. It made available data on the characteristics and refining possibilities of 92 of these oils that will be a standard reference for petroleum laboratories throughout the world.

In cooperation with the American Gas Association, the Bureau undertook a study of gas condensates and one of the productivity of high-pressure oil and gas wells; pipeline-flow investigations, including the development of accurate formulas for predicting the capacity of new gas pipelines and checking the efficiency of existing ones; and the completion of a reliable dew-point recorder needed to control the formation of hydrates in long-distance natural-gas pipelines.

Working with the American Society for Testing Materials, the Bureau undertook to administer the activities of a group of industrial and Government laboratories cooperating to determine the accuracy and precision of A. S. T. M. engine-test methods for rating aviation, motor, and Diesel fuels. With the Western Petroleum Refiners Association, the Bureau began a study of the compatibility and stability in storage of Diesel and burner oils.

In cooperation with industry, the Bureau continued periodic surveys of the characteristics of motor, aviation, and Diesel fuels marketed throughout the country. It continued study of the preparation, isolation, and purification of sulfur compounds in petroleum. It summarized 2 years of study of the combustion characteristics of Diesel fuels to provide practical information to engine builders and users.

HELIUM

The Bureau produced over 95 million cubic feet of helium in the year, making about 70 percent available to Federal agencies and selling the rest to non-Federal customers. For the first time since May 1945, the demand for helium exceeded the capacity of the Exell plant near Amarillo, Tex. The Amarillo plant was operated for 7 months until that at Otis, Kans., was reactivated in March 1951.

As the demand for grade A helium, 99.995 percent or more pure, increased, the Bureau increased its capacity to produce this grade. In a modest research program at Amarillo, a continuous recording instrument was developed to analyze grade A helium for hydrogen. Samples of natural gas from several new fields were analyzed for helium.

EXPLOSIVES AND EXPLOSIONS RESEARCH AND TESTING

Explosives Research

The Bureau made about 1,750 tests of permissible and special explosives and hazardous chemicals during the year. One permissible explosive was put on the inactive list, and 5 were added to the active list, raising it to 178. About 27 percent more permissible explosives were used in coal mines than during the previous year, and the ratio of black blasting powder to permissibles (less than 15 percent) was the lowest in history.

More efficient and safer stemming materials were sought for use with permissible explosives. An extensive study of the mechanism of ignition of firedamp by explosives, utilizing a new high-speed camera, yielded data promising a more positive approach to the problem of the ignition hazard of explosives.

A number of new nitrated furane derivatives have been synthesized and tested during the Bureau's search for more efficient and stable primary explosives. Experiments continued on the multiple-shot blasting of coal.

Gas- and Dust-Explosion Research

Continuing its efforts to help eliminate dust-explosion hazards in industry, the Bureau tested 70 different dusts. Progress in basic studies of the mechanism of the propagation of dust explosions was expedited by improvements in experimental techniques.

The Bureau also investigated the explosive characteristics of a number of new flammable liquids and gases. The causes of several industrial explosions were studied on the spot. An investigation of the ignition and explosion hazards of certain aircraft fuels was begun for the Armed Services.

Based on the Bureau's previous work on the fundamental properties of flame, considerable progress was made on the problems arising from the combustion instability of appliances when supplied with a substitute gas of equal heat value but different chemical composition from that for which they were adjusted. Progress is continuing in fundamental research on ignition and flame propagation.

SAFETY AND HEALTH ACTIVITIES

Promoting safe and healthful working conditions in the mineral industries is one of the oldest responsibilities of the Bureau. Over the past 41 years, an effective technique for fulfilling it has been developed. This consists of (1) conducting research and investigations to identify existing hazards and discover ways of correcting them; (2) conducting educational and training activities to impart the knowledge gained to supervisors and workmen throughout the industries; and (3) inspecting individual coal mines to determine specific hazards and recommend steps to correct them.

Work on Primary Hazards

Between 80 and 85 percent of the fatalities and about 45 percent of all injuries in American coal mines during the past 2 years have been caused by falls of rock and coal or by haulage accidents. Falls of rock and ore are also the principal cause of fatalities in noncoal mines, and haulage accidents are a heavy contributor. During the fiscal year, in accordance with its policy of concentrating upon the hazards that are most serious at any given time, the Bureau intensified its research and investigations on roof control and haulage operations.

It also accelerated its educational and training activities in these two fields.

With regard to roof control, special attention was given to roof bolting. This method of roof support, which the Bureau has been sponsoring in the coal-mining industry since 1947, has achieved even greater success than was originally anticipated. By the close of the fiscal year, roof bolts were being used to supplant or supplement conventional timbering in 494 coal mines, where they were supporting about 150,000,000 square feet of roof. A survey at the end of the fiscal year revealed that roof bolts were being manufactured in the United States at the rate of 2 million a month, and all were being used in mines. Roof bolts were being employed in 54 noncoal mines, supporting about 25,000,000 square feet of roof. Experience has shown that roof bolts, properly installed under suitable conditions, increase not only safety but also efficiency in both coal and ore mines.

Research on technical problems involved in this method of roof support was continued in the field and the laboratory. A cooperative study of mine roof proceeded at the Dehue, W. Va., mine of the Youngstown Mines Corp., where color photography of the inside of boreholes is being used. Studies of torquometer readings to determine bolt tension were continued, field data were gathered on hydraulic jacks, electrical strain gages were used to study roof action, and data on roof-bolting practices were collected. The initial tasks of designing and calibrating special equipment for roof-control research was completed, and the gathering and analysis of data were well underway as the year ended.

To assure that roof bolting would not be discredited because of improper installations, a number of Federal coal-mine inspectors were trained as consultants to advise mine operators wishing to install this method of roof control. Accident records of mechanized coal mines in States where roof bolts are used widely show a reduction in roof-fall injuries.

During the year, enough data on the circumstances under which roof-fall fatalities occur were accumulated to form the basis for an intensive effort to instruct supervisors and miners in recognizing and correcting roof hazards before they cause accidents. The need for such training, which will supplement the Bureau's regular accident-prevention courses, is emphasized by the failure of roof-fall fatalities to decline in proportion to fatalities from other causes. Coal-mine inspectors will be utilized to conduct this course and to take advantage of every opportunity to enlist the cooperation of mine personnel in eliminating the conditions and practices that contribute to accidents of this type.

During the year, the Bureau conducted a program of education and training on the prevention of haulage accidents, with good results. About 3,000 haulage employees, supervisors, and others took this course, which was based upon current studies of coal-mine-accident reports and was prepared in a special haulage-safety unit organized during the year.

The investigation of all coal-mine fatalities, upon which the Bureau embarked in February 1950, already has provided data that will be useful in all phases of its accident-prevention work. A report on each fatality investigated, describing the contributing circumstances in detail but refraining from any attempt to assess blame, is distributed to interested persons and agencies as promptly as possible. In addition, the information in these reports is condensed and published annually, so that the industry will have available the information needed for establishing effective safety programs.

Tests of Equipment

During the year, the Bureau continued to test electrically operated machines and appliances designed for use in mines to determine whether they are so constructed as to minimize gas- and dust-ignition hazards as well as those of electric shock. It investigated Diesel-powered mine locomotives and equipment to determine their safety for use underground. In addition, research was continued upon improvements in design and operation of equipment to minimize accident hazards.

This work has increased with growing mechanization of coal mining. Equipment meeting the Bureau's safety standards is approved as permissible for use in coal mines. Approvals are granted under 10 different schedules. The safety standards are published as schedules.

During the fiscal year 66 formal approvals were granted. Tests to determine flame-resisting qualities were made on 66 trailing cables. Changes in approved equipment were sanctioned by granting 102 formal and 1,129 informal extensions of approval. Approval was granted for one permissible Diesel locomotive for use in coal mines under standards much more rigorous than those established in countries where Diesel mine locomotives have been used with official sanction for many years.

In addition, during the year 9 new approvals and 34 extensions of approval were granted for respiratory protective devices. Check tests of approved types of equipment now on the market were made to determine whether they met the specifications upon which approvals were based.

Health Studies

During the fiscal year, the Bureau continued research and investigations directed toward minimizing health hazards in the mineral industries. Dust and particle-size determinations and X-ray diffraction, spectrographic, and petrographic examinations were made in connection with dust surveys in mines, in the analysis of dust-source materials, in the evaluation of materials for rock dusting in coal mines, and in connection with the Bureau's experimental work. Tests were continued at the Experimental coal mine at Bruceton, Pa., to determine the efficiency of dust collectors for use in connection with drilling for roof bolting in coal mines.

Exactly 16,091 gas and dust samples were analyzed during the year. They were collected in mines and tunnels, during investigative work for the Armed Services, in connection with the investigation of accidents or hazardous conditions, and in various laboratory studies. Some of these studies dealt with gaseous combustion products of coal-mine rubber belting, the health hazards of mercury vapor in Bureau laboratories, exhaust gases of Diesel-powered mine equipment, fume and dust concentrations during multiple blasting with millisecond-delay detonators in a commercial coal mine in Washington and in the Bureau's Experimental coal mine at Bruceton, Pa., and the efficiency of water sprays used during such blasting.

The Bureau gave the industry advice upon ventilating underground operations to be developed rapidly with Diesel equipment, prepared plans for ventilating the San Manuel copper mine, and gave advisory ventilation proposals to mine operators and to representatives of foreign countries. It also offered advice on air-conditioning deep western copper mines.

Literature research and the compilation of scientific information on industrial hygiene and preventive medicine in the mining and allied industries were continued. In addition, work was begun upon an annotated bibliography on air pollution, which will be the most extensive ever compiled upon this subject.

Safety Education and Training

Teaching supervisors and workmen first how to recognize and then how to correct dangerous conditions and practices is one of the most powerful weapons in the Bureau's accident-prevention armory. It has conducted safety classes in mines and plants throughout its 41-year history. New, specialized courses, including those on roof control and haulage mentioned above, have been added recently, and old courses are revised from time to time to keep them abreast of changing technology and incorporated the results of new research.

Two coal-mine accident-prevention courses are given, one for supervisors and those aspiring to become supervisors and the other for miners. Since the revised course for supervisors was offered in 1948, 12,276 mine officials have completed it, and 34,832 have completed the revised course for miners since its introduction in 1947. The Bureau also offers a metal-mine accident-prevention course, which was completed by 796 officials and key employees of mines and plants during the year; 203 others attended some of the classes. A similar course for employees of mills, ore-dressing plants, and smelters is ready for an initial try-out.

Lectures and demonstrations on static-electricity hazards, gas and dust explosions, and the fire hazards of dusts and gases were given to more than 11,000 persons in many States. Lectures on static electricity and proper handling of gasoline were presented before Air Force personnel at 10 air bases.

First-aid and mine rescue training was given to 35,485 persons in the mining and allied industries during the year, bringing to 1,806,013 the number who have had such training since the inception of the Bureau. During the year 334 new instructors were trained, raising to 18,564 the number who have qualified to teach the Bureau of Mines first-aid course. Certificates showing that all employees had taken first-aid training during the year were presented to 70 mines and plants.

For the first time since 1931, a national first-aid and mine rescue contest was arranged, in cooperation with several State mining departments, coal- and metal-mine trade associations, and mine workers' organizations. To be held during the fiscal year 1952, it will assemble crack teams from mines all over the country.

Coal-Mine Inspections

The Bureau's 250 coal-mine inspectors made 8,971 inspections during the fiscal year, raising the total since inception of the program to 41,986. Last year's inspections covered 6,360 mines; some of them were visited more than once.

The program carried on under the Coal-Mine Inspection Act of 1941 (Public Law 49, 77th Cong.) has proved an effective catalyst in stirring up efforts to prevent coal-mine accidents. After rising for 9 years before 1942, the fatality rate has since been declining, the rate of 0.90 fatality per million man-hours during the calendar year 1950 being the lowest in the statistical history of American coal mining. Although there was an increase in the rate during the first 4 months of the calendar year 1951, concerted efforts by management, labor, State mining officials, and the Bureau of Mines counteracted this trend in May.

That unceasing vigilance is the price of coal-mine safety was emphasized as two major disasters, one in a bituminous-coal mine in January and the other in an anthracite mine in March, taking a total of 16 lives, broke the longest disaster-free period in the history of American coal mining. It had lasted since November 1948. Both of the 1951 disasters were caused by the ignition of undetected gas accumulations in working places.

The authority of the Bureau's inspectors is purely advisory. They report all unsafe conditions and practices observed and recommend corrective action. Their reports also cite recent safety improvements and desirable features. Copies of each report are sent to the mine operator, the mine workers' organization, the State mining agency, and the joint Industry Safety Committee.

An important factor in obtaining cooperation in correcting hazards has proved to be postinspection conferences between the Federal inspectors and officials and workmen at the mines visited. In addition, the inspectors play a major role in the Bureau's various safety educational and training programs, conduct the investigations of fatal accidents previously mentioned, and act as judges at first-aid and mine rescue contests.

Although coal-mine injury rates are declining, much must be done before they are in line with those of other industries. During the year the correction of serious hazards reported by the Federal inspectors continued. However, 49 percent of their reports showed the existence of major hazards, and only 27 percent of their recommendations were adopted.

Accident Analysis

To increase the effectiveness of the coal-mine-inspection program, inspectors were supplied quarterly with data on the causes and frequency of injuries in individual coal mines and regional and branch supervisors with quarterly injury records for their areas. Increasing manpower difficulties in metal mines brought more requests for analyses of employment and injury data. At the request of the Defense Minerals Administration, a comprehensive monthly report on manpower problems and productivity in metal mines was planned. The defense program increased demands for data on production, consumption, and ingredients of industrial explosives. Nearly 200 operations enrolled in a new industry-wide safety competition for sand and gravel plants sponsored by the Bureau. Decentralization of the accident-analysis work to the regions was begun during the year.

Control of Fires in Inactive Coal Deposits

At the end of the fiscal year, 19 fires in coal beds not now being worked had been or were in process of being controlled, 10 on the public domain in Colorado, New Mexico, and Wyoming and 9 on private lands in Pennsylvania and West Virginia. Control or extinguishment of seven of these fires was completed during the fiscal year. Since the fiscal year 1949, when funds for this work first became available, it is estimated that more than 100,000,000 tons of coal have been saved from destruction at a cost to the Government of less than 1 cent a ton.

Anthracite Flood Prevention

Field work on some phases of the Bureau's study of the underground mine-water problem in the Pennsylvania anthracite region was completed during the year, and plans were prepared to aid in preventing the loss of large reserves by flooding. Boreholes drilled under contract at 15 shaft sites along the proposed line of a main tunnel to drain all the anthracite fields into the Susquehanna River near Conowingo, Md., furnished cores for a study of rocks and water seepage along the route. Construction quantities have been calculated for twin-tunnel, single-tunnel, and combination single-tunnel and central pumping-plant schemes.

Study was continued to determine the ability of the barrier pillars in the anthracite region to withstand hydrostatic pressure that may be brought to bear against them, to locate breaks in the barrier pillars, and to learn where openings may be made to combine underground pools. This study entails investigation of 6,000 pillars in some 186 collieries.

Another phase of the anthracite floodwater problem under study is the infiltration of surface water from streams that cross the anthracite measures and the devising of methods to control its leakage into the underground pools.

PUBLIC REPORTS

Under its organic act, the Bureau of Mines is directed "to prepare and publish reports of inquiries and investigations." In all, 589 manuscripts covering all phases of its work were approved and edited, compared with 680 in the fiscal year 1950. The sharp decline in number resulted largely from the assignment of many Bureau engineers, scientists, and economists to defense activities.

Results of Bureau investigations were made available to the industry and the public in printed and processed reports, in articles prepared for the trade and technical press, and in papers presented before various organizations interested in the Bureau's work. The printed reports included 18 bulletins, 1 technical paper, 67 Minerals Yearbook chapters and 1 bound volume, and 19 miscellaneous items such as handbooks and monthly and annual lists of publications—a total of 106. In addition, 96 reports of investigations, 43 information circulars, and 26 other manuscripts, including Mineral Trade Notes and reports for the National Security Resources Board, were prepared for processing—a total of 165. Papers for presentation before technical and professional societies and for publication in the trade press totaled 318. These reports included approximately 22,000 manuscript pages and 2,100 illustrations.

An index of nearly 5,000 items was prepared for Minerals Yearbook, 1949, and the Senate hearings on the Interior Department appropriation bill were indexed for the ninth consecutive year.

The number of showings of films from the Bureau's free loan library of educational motion pictures established another all-time record during the fiscal year. Bureau films were exhibited a total of 194,439 times, an increase of 11 percent or 20,131 over the 1950 record of 174,308. The total attendance at showings during the fiscal year was 12,639,968.

A total of 963 new copies of films were added to the film library during the year, and 1,225 copies were withdrawn owing to obsolescence and ordinary wear. At the end of the year, 6,017 copies of motion-picture films were in circulation.

Five new films became available for circulation during the fiscal year. They were Texas and Its Natural Resources, West Virginia and Its Natural Resources, A Story of Copper, Treasure from the Sea, and The Melting and Refining of Stainless Steel. Texas and Its Natural Resources is a revision of an earlier film of the same title. Treasure from the Sea is an animated color film on magnesium.

Bureau of Mines educational films are available in 16-millimeter width, all in sound except for a few of the earlier ones not yet withdrawn from circulation, and many in color. Like all films in the Bureau's free loan library, those added during the fiscal year 1951 were sponsored by industrial concerns which defrayed all costs incidental to production and provided the Bureau with enough copies for distribution to schools, colleges, training classes, the Armed Services, business and civic groups, and other recognized organizations. No charge is made for the loan of films, but the borrower pays for transportation and for any damage other than ordinary wear and tear.

ADMINISTRATION SUMMARY

Increased emphasis was placed on continued improvement of program and administrative functioning.

A notable development was the initiation of semiannual conferences of regional directors and administrative personnel devoted to discussions of technical and administrative procedures. Conferences were held in Washington, D. C., and Amarillo, Tex., during the year. The conference held the week of March 12 in Washington was devoted to budget and accounting, personnel, and property-management matters. These conferences resulted in better all-around understanding of the detailed requirements as well as of the over-all objectives.

Authority has been delegated to regional directors, regions I through VIII, to make appointments and status changes in positions in GS–1 through GS–11 and CPC–1 through CPC–10 which have been allocated and established, and all ungraded positions, as well as to fill vacancies vice such positions, and to take additional identical actions on such positions. Also, the regional director, region IV, is authorized to allocate positions up to and including grade GS–7, and the regional director, region VIII, is authorized to allocate positions up to and including grade GS–11. Some officials in charge of field stations under the jurisdiction of regional directors are also authorized to make appointments and status changes in positions in GS–1 through GS–7; CPC–1 through CPC–10; and all ungraded positions.

The Office of the Bureau Safety Engineer is charged with the formulation and direction of a program to improve the health and injury experience of employees. There are six full-time safety engineers and one safety inspector in four synthetic liquid fuels plants. At each of three additional stations, all metallurgical, an employee functions as safety engineer besides carrying on his regular duties, and two of the helium plants have safety committees whose chairmen have safety matters directed to them but who do not otherwise function as safety engineers.

The injury-frequency rate, which is the number of lost-time injuries per million man-hours of work, was 12.4 for the calendar year 1950. Although this represents only a small percentage reduction as compared to the value of 12.8 for calendar 1949, except for the abnormally bad record of a single station there would have been an improvement of nearly 12 percent in the 1950 frequency rate as compared with that of the preceding year. Every effort is being made to improve the injury experience at this station, including the designation of an employee as a full-time safety engineer. The severity rate which is the number of days lost per thousand man-hours, was 1.39—an improvement of nearly 17 percent over calendar 1949. But this includes a highway fatality that may or may not be finally chargeable as occupational on the basis of whether or not being on per diem is technically an "on duty" status for hours actually off duty. If this fatality is decided as not chargeable, then the 1950 severity rate will be 0.74, nearly 56 percent lower than the preceding year. Fires, although fewer in number in 1950, caused property damage estimated at $9,819 as compared with $5,785 in 1949. Eighty-one percent of the total damage occurred at one (experimental) plant where high-temperature, high-pressure hydrogenation processes are extremely dangerous, potentially, but where every effort is made to prevent and to control fires. Motor-vehicle accidents were 19 percent greater in number and property damage 40 percent higher in 1950 than in 1949, both less than in 1948, but no person was seriously injured. Four tort claims were approved for total damages to privately owned cars of $264.30.

There is evidence of continuous improvement in the occupational health and safety of Bureau of Mines employees.

On June 30, 1951, there were 5,001 full-time employees in the Bureau of Mines, distributed as follows:

Table 1.—*Classification and number of appointees*

	GS[1]	CPC[2]	Total
Departmental	725	11	736
Field	3,885	380	4,265
Total	4,610	391	5,001

[1] Includes instrument makers, safety instructors, laboratory aids, assistants, etc.
[2] Includes laborers, mechanics, messengers, wage employees, etc.

PROPERTY

Property records of the Bureau of Mines, as of June 30, 1951, show accounts as follows:

Automobiles and trucks	$1,675,612.70
Canvas and leather goods	21,102.82
Drafting and engineering instruments	93,120.49
Electrical equipment	347,654.61
Hardware and tools	406,565.45
Household equipment	90,521.96
Laboratory equipment	5,382,060.41
Medical equipment	38,173.85
Office furniture and equipment	1,835,893.15
Photographic apparatus	168,132.76
Machinery and power-plant equipment	5,734,293.49
Land, building, and improvements	20,847,438.62
Specialized equipment and apparatus	8,540,814.72
Total	45,181,385.03

This property is in Washington, D. C., and at the various field stations and offices of the Bureau.

FINANCE

The total funds available to the Bureau of Mines for the fiscal year ending June 30, 1951, including direct appropriations, prior year balances available, reimbursements, transfers and advances from other Government agencies, and advances from other than Government agencies, were $41,835,210. Of this amount $29,975,088 was obligated, leaving an unobligated balance of $11,860,122.

Funds available to the Bureau of Mines for fiscal year 1951 (by source of funds)

Direct appropriations		$24,981,100
Deduct:		
Reserves for savings required by section 1214, General Appropriation Act, 1951	$360,000	
Transfer of funds to finance defense activities	515,000	
		875,000
Net, direct appropriations		24,106,100
Prior year balance available (includes $6,600,000 of contract authorization)		10,198,344
Reimbursements from other Government agencies		1,099,349
Advances from other than Government agencies		957,461
Advanced or transferred from other Government agencies		5,473,956
Total		41,835,210

Obligations incurred by the Bureau of Mines in fiscal year 1951 by appropriation

Conservation and development of mineral resources:	
1. Fuels:	
(a) Coal	$2,023,451
(b) Petroleum and natural gas	1,146,730
(c) Synthetic liquid fuels	7,746,371
(d) Helium	92,574
2. Minerals and metals:	
(a) Ferrous metals and alloys	2,111,661
(b) Nonferrous metals	2,646,065
(c) Nonmetallic minerals	774,651
(d) Mineral research, unclassified	366,982
3. Control of fires in inactive coal deposits	324,593
Total, conservation and development of mineral resources	17,233,078
Health and safety:	
1. Investigation of accidents and rescue work	792,455
2. Mine inspections and investigations	2,533,468
3. Explosives and explosions testing and research	471,948
Total, health and safety	3,797,871

***Obligations incurred by the Bureau of Mines in fiscal year 1951 by appropriation*—Continued**

Construction:	
1. New laboratory facilities	$654, 573
2. Drainage tunnel, Leadville, Colo	465, 382
3. Synthetic liquid fuels	605, 283
Total, construction	1, 725, 238
General administrative expenses	1, 284, 433
Construction and rehabilitation, Bureau of Reclamation (transfer to Bureau of Mines)	209, 265
Development and operation of helium properties	538, 550
Helium production	841, 507
Working fund, Interior, mines	4, 136, 435
Contributed funds	92, 885
Expenses, international development, Executive Office of the President (allotment to Interior) 1951	115, 826
Total, Bureau of Mines	29, 975, 088

Geological Survey

W. E. Wrather, Director

IN PEACE OR WAR the work of the Geological Survey is a prerequisite in guarding the Nation's raw materials and energy sources, expanding production facilities, and carrying on many other activities that contribute to maintaining the economic base for our American way of life. Today, with oil, gas, coal, strategic metals, and other valuable commodities being used at an enormously increased rate and with our supply of water, once believed limitless so far as our needs are concerned, beginning to be used to its maximum capacity in more and more areas, the farseeing programs of the Survey's four divisions are tremendously important. At present the Geologic, Topographic, Water Resources, and Conservation Divisions are devoting their best efforts to meeting the very real needs of national defense, yet the Survey from its earliest days has been concerned with the wise utilization of our natural resources; instinctively, it will bear in mind the Nation's long-term needs during this present emergency as it has during other times of crisis.

GEOLOGIC DIVISION

The emergency created by the Korean hostilities caused serious problems in the Division during fiscal year 1951. Those activities which contribute most directly to national defense have had to be enlarged and new defense activities begun. Duties have been assigned to the Geological Survey under the Defense Minerals Administration and the Petroleum Administration for Defense, and members of the Survey staff are serving as advisers to the National Security Resources Board and the President's Materials Policy Commission. Geologic investigations in foreign areas and the military geology program are being expanded.

The problem of staffing has been met to some extent by delaying or interrupting other activities, but in spite of increased responsibilities the regular program of investigations and research necessary for the long-range welfare of the Nation's mineral industries is continuing and every effort will be made to enlarge it during the next fiscal year.

Mineral Deposits

The traditional functions of the Mineral Deposits Branch were supplemented during the past year by special defense activities.

Personnel participated in the establishment and development of the Defense Minerals Administration. At the request of this agency, commodity geologists recommended special programs designed to reduce deficiencies in the supply of 23 strategic and critical mineral commodities. By the end of May more than 975 applications for Government assistance involving 47 commodities had been referred to the Survey for appraisal and recommendations. Approximately 75 percent of these can be appraised on the basis of published and file data, but the remainder require special field study. About 500 applications had been processed and nearly 100 field examinations completed by June 1.

Confidential reports on the world resources of 12 strategic metals and minerals were prepared for the National Security Resources Board during the year. A request for similar reports on 34 other mineral commodities was received for completion during fiscal year 1952.

The President's Materials Policy Commission is allotted a full-time liaison man and consultant, and assignments on the marginal ore reserves of 15 mineral commodities and on a list of unpublished Survey documents concerning mineral resources have been completed. Study of exploration and discovery practices for several important minerals is in progress.

Although these special activities have retarded the Survey's regular program of geologic mapping and research, 91 Mineral Deposits Branch projects, some in the report-preparation stage, were active in fiscal year 1951. These projects dealt with more than 30 different mineral commodities in 31 States. About three-quarters of the program was focused on strategic minerals; most of the remainder was concerned with commodities like iron, potash, and phosphate, which, though not now classed as strategic, are essential to the continued welfare of the Nation.

Projects supported by regular Survey appropriations and by transfer of funds from other Department agencies and from seven States included studies of such commodities as copper, lead, zinc, ferroalloys (chromium, tungsten, manganese, cobalt, and titanium), iron, precious metals, fertilizer materials (potash and phosphate), thorium and rare earths, beryllium, mica, talc, and ceramic materials (feldspar, kyanite, sillimanite, cordierite, and clay). Exploratory drilling was carried out in nine areas.

Mapping of geologic structure in the Menominee-Crystal Falls Range, Mich., has led to the discovery of important new iron-ore deposits and new ore-bearing areas. Continued geologic work on the rare-earth deposits near Mountain Pass, Calif., has resulted in the discovery of entirely new deposits that are being explored by private mining interests.

Rapid field tests for use in geochemical prospecting were developed for molybdenum, tungsten, cobalt, nickel, and silver, making a total of eight elements for which field analytical methods devised by the Survey are now available. Special equipment needed will soon be available commercially. Geochemical prospecting methods continued to be applied successfully both by the Survey and by mining companies.

The work done for the Atomic Energy Commission was expanded, particularly in reconnaissance for radioactive materials and in the trenching, drilling, and sampling of uranium deposits in Colorado, Arizona, and Wyoming. Further exploration, sampling, and tonnage-grade studies were conducted in the phosphate fields of Florida, Idaho, and Montana.

New projects approved to start late in the year include the geologic mapping and study of the iron-manganese deposits of the Cuyuna Range, Minn., clay deposits in the foothills of the Front Range, Colo., and tungsten and quicksilver deposits in Nevada; further geologic mapping and appraisal of manganese reserves near Batesville, Ark., in cooperation with the Bureau of Mines and the Arkansas Geological Survey; and a research project on the origin, extent, thickness, and grade of phosphate- and uranium-bearing sediments off the west coast of Florida.

Publications during the year included professional papers on the geology and ore deposits of the Front Range of Colorado with its more than 30 mining districts, on beryl and mica pegmatites of Idaho and Montana, and on the Pleistocene shore lines of Florida and Georgia and their possible relation to the pebble phospate deposits, as well as 27 bulletins, circulars, and scientific articles on many other studies.

Petroleum and Natural Gas

The Survey's oil and gas investigations, made available to the public by means of maps and reports, include studies of the distribution, structure, and variation in thickness of the rocks; the presence or absence of source beds and reservoir rocks; regional changes in formations that might cut out oil-bearing beds at depth or produce stratigraphic traps; and lateral changes in the character of the rocks that have a bearing on the accumulation of oil and gas in reservoir rocks.

In collaboration with the oil and gas industry, State geological surveys, and other geologic organizations, the Geological Survey has been able to conduct 59 regional investigations during fiscal year 1951. These investigations, which ranged from detailed mapping bed by bed where the rocks are exposed to the correlation of rocks in the subsurface by means of samples, cuttings, and cores, were carried on in half the States of the Nation.

Survey geologists in western Texas are establishing the regional correlation of rocks of Pennsylvanian age in which the reef oil fields of Scurry County were found and have initiated geologic studies of the stratigraphy, structure, sedimentology, and facies relations of the reefs and the relation of the oil pools to the reefs. These investigations, which are sponsored by the Petroleum Administration for Defense in cooperation with the Bureau of Mines, are designed to obtain data that will be helpful in guiding the development of reef fields in the Scurry area.

Eighteen maps, charts, professional papers, and circulars providing basic data as an aid to oil and gas exploration in many areas were published during the year. Also, 22 reports prepared by the Geological Survey were published by State geological surveys or in technical or trade journals.

Oil Shale

Detailed geologic mapping of the largest high-grade oil-shale deposits in the country was continued during the year. The major objective in these investigations is to determine the extent, depth, and reserves of the richer oil-shale zones of the Green River formation in northwestern Colorado and in northeastern Utah. Delimitation of the most promising parts of the oil-shale deposits in Colorado by field mapping and stratigraphic studies is nearing completion, and investigation of the deposits in Utah is being undertaken. A map showing the distribution, thickness, depth, and estimated reserves of the oil-shale zones in the eastern part of the Piceance Creek structural basin, in Colorado, has been published; reports on two more areas within this basin are nearly complete.

Coal

In connection with the urgent task of reappraising the coal resources of the United States, new detailed estimates of the coal resources of Michigan, New Mexico, and Wyoming were published during the year; coal-resource studies in South Dakota, Indiana, North Dakota, and Virginia are in progress; and reports on the coal resources in Wyoming and the total coal resources of the United States have been published.

Also, the Geological Survey has completed and published the results of detailed mapping of the coal beds in parts of the anthracite fields of Pennsylvania and two districts in Colorado and Washington. A report is in preparation on the results of core drilling in the Lake De Smet area of Wyoming, which revealed a continuous bed of subbituminous coal about 100 feet thick and under less than 100 feet of overburden over much of an area of 2½ square miles.

Geologic mapping of coal deposits was carried on in Custer and Powder River Counties, Mont., in eastern Montana, and in Indiana and Kentucky.

Engineering Geology

During fiscal year 1951 geologic mapping in cooperation with construction agencies was continued in Puerto Rico, Massachusetts, and Rhode Island and along the Snake River in Washington, and several new projects were started in areas where major engineering works are planned. The purpose of these projects is to supply basic geologic data during the planning and before the construction stage when the lack of complete information may prove costly. The data made available include depth to bedrock, sources of construction materials, foundation conditions, and information as to the stability of possible landslide areas.

The geologic mapping of larger cities is being accelerated in line with the conversion of the Survey's activities to meet the present emergency. The mapping of Portland, Oreg., and Knoxville, Tenn., is now in progress. Geologic investigations were made in relation to underground-shelter construction in downtown San Francisco for the Federal Civilian Defense office, and alternate bridge sites across San Francisco Bay were studied. Knowledge has been gained regarding the occurrence and causes of landslides, foundation conditions, availability of construction materials, and minerals of economic importance.

A large part of the engineering geology program is centered on the Missouri River Basin in support of the Department's program for development of the basin. Suitability for irrigation, availability of construction materials, susceptibility to landslides, and the waterholding capacity of possible reservoir sites are some of the special problems studied.

Research is being conducted in the Upper Columbia River Valley in Washington to determine the effect of water-level fluctuation on landslides. Upper Pennsylvanian channel sands are being studied in detail in eastern Kansas. Geologic mapping was continued at the Fort McDowell dam and reservoir site in Arizona. In all, 25 field projects were in progress in 14 States and Puerto Rico.

During the year, 67 reports were made available to the public by being placed on open file in Washington, D. C., and Denver, Colo.; 5 reports were published by the Survey; and 3 reports were published in professional journals. A special report was prepared for the United States Navy on the sand and gravel resources of Naval Petroleum Reserve No. 3 near Teapot Dome, Wyo., and one for the Atomic Energy Commission dealt with the Rocky Flats plant site near Denver. Translations and abstracts of selected foreign literature on engineering geology were made and placed on open file in both Washington and Denver.

General Geology

During fiscal year 1951 general geologic investigations were in progress in such widespread areas as California, Alaska, North Dakota, and Hawaii. In the Mohave Desert of California general geologic studies made it possible to outline the potentially mineralized area of rare-earth deposits; intensified and detailed geologic studies led in turn to new discoveries of major importance. Stratigraphic studies in western North Dakota will aid in the exploration of oil in that State. Encouraging progress in the prediction of volcanic eruptions and the consequent saving of lives and property was made in Hawaii. Studies in the Aleutian Islands were continued and provided the basis for advising the Department of Defense on certain problems.

Geophysics

During the past year a new plan of organization for geophysical activities was set up. Several projects formerly carried on for the Atomic Energy Commission by two other branches of the Division were transferred to the Geophysics Branch and set up as the Radiation Section. Other projects were organized in three sections: Airborne Surveys, Ground Surveys, and Basic Investigations.

Airborne surveys, both aeromagnetic and aeroradiometric, included a total of 43,100 miles of traverse in 12 different States. Compilation of 49,530 miles of data was completed, 31 maps were released in open file, and 63 maps were published. Of special interest were the surveys in Minnesota, Michigan, and Maine. An apparent extension of the iron-rich Vermilion Range in Minnesota was indicated by the magnetic anomalies, and drilling by mining companies is reported to be in progress. Aeromagnetic work in the iron areas of Michigan was continued, and the results are proving useful in tracing buried structure. In northern Maine, where magnetite is associated with manganese minerals, an aeromagnetic survey was begun to locate extensions of known deposits and to explore adjacent unmapped areas for additional deposits. Of scientific interest were flights in cooperation with the Navy over the continental shelf.

Ground surveys were made in 12 States, using magnetic, seismic, and electrical methods. Magnetic surveys were made in conjunction with aeromagnetic surveys in northern Maine for manganese and in Delaware for areas favorable to drilling for water supply; shallow-refraction seismic surveys were carried on in Massachusetts and California to determine depth to bedrock; and electrical surveys in Minnesota, Wisconsin, Ohio, Kansas, California, and the Colorado Plateau served such varied purposes as determining depths of aquifers, locating highway materials, studying buried valley systems, and finding areas favorable for lead-zinc and carnotite ores.

Valuable information on thermal profiles and gradients in ice and permafrost is being obtained from the program of temperature measurements in drill holes in northern Alaska. Three seismic observatories were operated in the Aleutian Islands.

Mathematical investigations included a continuing project on the extension of resistivity tables for the flow of current in multiple-layered ground, methods of interpreting aeromagnetic surveys, and a report in cooperation with the Naval Ordnance Laboratory which showed that broad magnetic anomalies may extend to altitudes of 20 miles. Abstracts of literature on both earth physics and applied geophysics in current domestic and foreign periodicals were prepared and published in the quarterly Geophysical Abstracts.

Geochemistry and Petrology

Essential to geologic study are the identification of rocks, ores, and minerals and the elucidation of physical-chemical processes operative in the formation of those materials.

During the year the Branch of Geochemistry and Petrology inspected more than 43,000 samples for geologists and the general public. In addition to equipment for grinding rock samples and thin and polished sections, facilities are available for making full chemical analyses and petrographic examinations, determining radioactivity, making spectrochemical and X-ray determinations, making thermal analyses, and conducting studies in electron diffraction and microscopy and optical and X-ray fluorescence.

Techniques were developed in cooperation with other laboratories to reduce the time required to perform approximate chemical analyses of sufficient accuracy for many geologic studies, and improved methods designed to increase the accuracy of certain types of analyses were worked out.

Research work completed during the year dealt with special chemical analytical methods; chemical methods for field use; special analytical aids such as nuclear track plates, high-index liquids, and an instrument for measuring fluorescence; base-exchange studies; thermal analyses; descriptions of new minerals; and geochemical and mineralogical studies.

Paleontology and Stratigraphy

The Paleontology and Stratigraphy Branch supplements the work of other Geologic Division units and publishes reports on research findings for the information of geologists and the general public.

During fiscal year 1951 the old paleontological collections were rearranged for greater accessibility and new collections were catalogued; the staff was augmented in order to deal with the backlog of referred material; and new equipment and improved facilities were acquired for more efficient working conditions.

A total of 389 reports on referred collections comprising about 40,000 specimens and ranging in age from Cambrian to Recent were transmitted by the branch. These collections came from 33 of the 48 States and from 16 foreign areas or territories.

Reports on research were completed by most members of the Branch; of these, 43 have been approved for publication and 27 have been published. Many of the reports represent basic contributions to the stratigraphy, paleontology, and paleoecology of North America and the Pacific. Included are papers on the geology and paleontology of the Santa Maria district, Calif., on organic growth and sedimentation on an atoll, on the age of the lower Stanley shale, and on the Jurassic of the Green River region.

Geologic Investigations in Alaska

The Korean situation has caused considerable change of emphasis both in the planning of new projects and in the orientation of existing projects in Alaska. To the Geological Survey this has meant increased emphasis on the study of construction materials used in military, railroad, and highway developments, of fuel resources for internal consumption and possible export, and of the so-called strategic and critical minerals needed in the military and civilian supply program in the United States.

Various mineral deposits were studied during the fiscal year. Survey geologists investigated limestone deposits west of the Alaska Railroad in the Foggy Pass area; construction materials in the Railroad-Highway block; pumice along the west shore of Cook Inlet; riprap material on Kodiak Island; a tin deposit on Seward Peninsula; the tungsten deposits in the Fairbanks area; and copper deposits in the Prince William Sound district. Detailed and reconnaissance mapping of mineralized areas was carried on in the lower Kuskokwim region in southwestern Alaska and in the Glacier Bay area of southeastern Alaska; the Juneau gold belt; the Willow Creek mining district; and the Haines-Skagway area, with emphasis in the last-named area on the iron deposits in the vicinity of Klukwan.

Coal investigations were again focused on the Matanuska and Kenai coal fields. In the Matanuska field a Survey geologist was assigned to the study of cores recovered during a Bureau of Mines drilling program; in the Kenai area additional coal sections were measured and sampled in an effort to extend and delimit the boundary of the Kenai coal field prior to undertaking inland investigations.

Increasing interest in Alaskan petroleum possibilities was reflected by the extension of geologic studies northward from the Iniskin-Chinitna area to Tuxedni Bay and the continuation of field work in the Yakataga and Katalla areas. A preliminary report on the Yakataga field was released for public use late in the fiscal year. In northern Alaska petroleum investigations were continued as in past years, largely financed by Navy funds.

Reconnaissance investigations in search of fissionable materials were carried on in various parts of the Territory with funds provided by the Atomic Energy Commission.

The activities of the Defense Minerals Administration played an increasingly prominent role in the assignments of Survey personnel in the Territory. A small but adequate working unit was established at Juneau, and other geologists were made available to meet specific needs.

Military Geology

For the ninth consecutive year the Survey provided geologic advice to the Armed Forces through its Military Geology Branch. The activities of this branch were expanded rapidly to meet the heightened demands created by the world situation. Information was supplied on the geology, soils, terrain, and water supply of many areas.

As in the past, most of the Military Geology Branch projects were supported by the Corps of Engineers under a cooperative agreement. A major portion of the Branch activity is conducted in Washington, where a research staff gathers and interprets the basic data on foreign areas, making use of the maps and the scientific and technical literature in the Geological Survey Library.

The existing field programs of the Military Geology Branch were continued. In the Trust Territory of the western Pacific, the detailed geologic and soil mapping of Tinian Island in the Marianas group was completed. A military geologic folio based on the field investigations is being prepared, along with folios on several other islands previously mapped. The mapping program, projected over a period of several years, will cover most of the islands of the Trust Territory. In addition, arrangements were completed for mapping the geology and soils of Guam, now under the jurisdiction of the Department.

The special problems created by terrain, geologic, and vegetation conditions in the Arctic and sub-Arctic were studied further in Alaska. Construction in the Territory is affected greatly by the presence of permafrost, which is therefore a primary object of investigation. Geologists and botanists are collaborating to extend knowledge of the basic characteristics of permafrost and associated phenomena from an investigation of selected areas and are applying their findings to the solution of military problems. The field phase of a special investigation on ground ice, conducted at Barrow, Alaska, was ended, and results are now being compiled in a report.

Military geologic folios covering several Alaskan areas, as well as one on Fort Benning, Ga., and the Sixth Army area, are now in preparation.

Foreign Geologic Investigations

The Geological Survey's program of extending scientific and technical assistance to those areas of the world possessing relatively underdeveloped economies began in 1940. With the exception of assistance to Liberia and the Philippines, this work was confined until 1949 to countries of the Western Hemisphere. In 1949 legislation enabled the Survey to begin acting on numerous requests from the countries of the Eastern Hemisphere. The launching of the President's Point Four program this fiscal year gave added impetus to these activities.

Geologic investigations in the Western Hemisphere during the year included studies of copper, lead, zinc, silver, and phosphate deposits; volcanological research in Mexico; cooperative studies of the lead-zinc-copper deposits of Hualgayoc, Peru; observations made during Peru's Cusco earthquake in May which are aiding in the current reconstruction of housing in the area; evaluation, study, and mapping of the rich Minas Gerais iron ores in Brazil; observation of the eruption of Mount Santiago in Nicaragua and consultations with the Nicaraguan Government on measures to be taken for the protection of the population, livestock, and agriculture; mineral investigations in Venezuela; and studies of recent earthquake damage in Ecuador in cooperation with that country's program for rehabilitation of earthquake-devastated areas. Six bulletins were published in fiscal year 1951, dealing with geologic investigations in Mexico, Chile, the Dominican Republic, and Colombia.

In the Eastern Hemisphere a country-wide minerals reconnaissance was completed in cooperation with the Royal Department of Mines of Afghanistan. Ground-water investigations were conducted in India and Saudi Arabia. In the new Philippine Republic the Survey's mission continued its role as adviser to the fast-growing Philippine Bureau of Mines and engaged in detailed geologic mapping of manganese deposits on Siquijor and Busuanga Islands.

A total of 19 in-service training awards were made during fiscal year 1951 to promising young technicians from India, Pakistan, Brazil, Mexico, and the Dominican Republic. Although scientific and technical aspects of training have the most attention, these men are also given a thorough review of the Survey's administrative practices and organizational procedures in long-range planning for country-wide geological surveys (mineral and water-resources) and mapping.

Under the sponsorship of the Economic Cooperation Administration, a specialist advised the Government of Thailand on the development and utilization of lignite deposits. Final reports were prepared on investigations of Korean coal deposits carried out before the beginning of the present hostilities.

Geologic Maps

During the year the Office of Geologic Cartography, in conjunction with its six field units, prepared 1,853 geologic maps, charts, diagrams, and other illustrations for multicolor and black and white reproduction. Final copy for seven maps in the geologic quadrangle series and one mineral investigations map was transmitted to the branch of map reproduction. This is an increase of 80 percent over the number transmitted last year. Fifteen other multicolor maps are in various stages of preparation.

The geologic map editor reviewed and edited 2,287 maps and figures involving more than 265 reports. Some 73 percent of these illustrations were designated for publication by the Survey; the remaining 27 percent were routed for publication by cooperating State and Federal agencies or by scientific journals.

Library

Fiscal year 1951 was notable in the history of the Library for the development of the new system of branch libraries, necessitated by the permanent location of geologists in the field. Branch libraries in Denver and San Francisco are being developed by additions to the staff and by augmentation of working materials.

The main library in Washington had over 17,000 readers, made more than 32,000 loans of materials for outside use, and had a total circulation of over 100,000. This very nearly equals the record year of 1950. Almost 22,000 pieces of new material were received during the year.

TOPOGRAPHIC DIVISION

The mapping program carried on by the Topographic Division in fiscal year 1951 was considerably larger than in previous years, with major emphasis given to the production of large-scale topographic maps of critical and economically important areas throughout the United States and Alaska. Federal-State cooperative mapping programs were in progress in 26 States and Puerto Rico, and field operations were started for the revision of the obsolete map series covering the Hawaiian Islands. Progress continued on the compilation of the Transportation Map of the United States being prepared for the Bureau of Public Roads, and the compilation of small-scale aeronautical charts covering world-wide areas was continued for the Department of the Air Force. An expanded program of surveying and mapping was undertaken to supply the high-priority requirements of more than 15 Federal agencies which need topographic maps for planning, general economic, and military purposes.

Shortly after the outbreak of the Korean war, an urgent request came from the Department of Defense for the completion of high-priority defense mapping. In view of this request and the world situation in general, current mapping operations and the programing of future operations were given detailed analysis and the overall mapping program sharply reoriented to expedite current mapping in critical areas and to provide for a 6-year mapping program designed to meet defense needs. The objectives of this long-range program envision the early completion of topographic maps for strategic areas and the coordination within defense requirements of mapping in certain areas which contain valuable natural resources or which are otherwise important to the Nation's economy.

Throughout the year research was carried on for the purpose of developing new techniques and methods to meet the demands for more maps and charts. Advanced stereoplotting instruments for compiling map detail give promise of accelerating the progress of aerial mapping. Helicopters have been used successfully to transport men and survey equipment to the tops of mountains and other difficult locations in remote areas for making control observations. A new method of precision barometric altimetry, known as the "leapfrog method," has been successfully used to determine elevations for topo-raphic maps. Electronic methods used for obtaining control include horan and radar altimetry. These new techniques are especially ap-licable in the vast expanses of unmapped lands in the Western States nd in Alaska which may loom large in the strategic picture.

Map-making facilities in the regional offices were expanded to pro-ide for faster schedules of map completion. The facilities of the hotographic laboratories have been enlarged, and new equipment in-talled in the Survey's optical laboratory will provide for the testing nd calibration of precision aerial cameras.

The supplying of information on maps and related data, as well as hotographic or photostatic reproductions of new mapping prior to ublication, has been given special consideration. During the year uxiliary map-information centers were established in Tulsa and Boston.

Technical assistance was given to other nations through coopera-ion with the Economic Cooperation Administration, the Pan Amer-can Institute of Geography and History, and the Department of State.

Mapping Programs and Map Production

An expanded topographic mapping program was carried on in the 48 States, the District of Columbia, Alaska, Puerto Rico, and Hawaii. Federal-State cooperative mapping projects, whereby half the mapping funds are supplied by the State and half by the Federal Government, were conducted with 26 States and Puerto Rico. The Survey also continued to assist the Tennessee Valley Authority in completing the topographic mapping of the valley—a program designed to provide standard 1:24,000-scale maps over an area of 40,000 square miles. In the continental United States and its Territories and possessions, mapping was in progress on approximately 3,700 quadrangles during the year.

New mapping projects were selected on the basis of requests submitted by the principal Federal map-using agencies through the Bureau of the Budget and from State, county, and municipal requests as directly received by the Geological Survey. The agencies cooperating in topographic mapping included such long-time cooperators as New York, Massachusetts, Virginia, Pennsylvania, Vermont, Indiana, Illinois, Missouri, Arkansas, North Dakota, Kansas, Louisiana, Michigan, Wisconsin, California, Washington, and Puerto Rico. More recent cooperators, or those resuming cooperative programs, were Connecticut, Iowa, Kentucky, Maine, Minnesota, North Carolina, Tennessee, Utah, and Mahoning County, Ohio.

The largest cooperative project undertaken to date by the Surve is the 5-year cooperative mapping program in Kentucky. This mapping will provide a uniform series of 1:24,000-scale maps for the entir State as a basis for the development of natural resources and the expansion of transportation and industrial facilities.

In the Missouri River Basin, extensive topographic mapping operations were continued. The mapping in progress in this area durin the year covered 75,000 square miles (48,000,000 acres).

All mapping in Alaska was accelerated. Under the over-all program, the coordinated compilation and map-finishing facilities of th three western regions were utilized to compile and finish large-scal maps covering 30,000 square miles. The 1:250,000-scale series o Alaska maps was advanced to a point where it is more than a yea ahead of schedule.

In the continental United States (excluding Alaska) approximately 61,000 square miles (39,040,000 acres) of domestic mapping was completed, including 8,700 square miles (5,568,000 acres) of map revision. In the first phase of mapping operations 50,000 square miles (including 9,350 linear miles of transit traverse) was covered by third-order horizontal control, 55,000 square miles (15,900 linear miles) by vertical control, and 51,700 square miles by supplemental control. In the second phase 52,300 square miles was compiled by stereoscopic methods, 2,350 square miles of which was done under commercial contract. In the third phase 61,000 square miles was compiled in the field. In the fourth phase 49,000 square miles was drafted and prepared for reproduction. A detailed summary of production covering new mapping, remapping, and revision, as well as the total mapping completed for each of the States, Territories, and possessions, is shown in the following table.

Areas, in square miles, mapped during fiscal year 1951 for publication on standard scales

[Contour intervals, 5 to 100 feet]

State	Scale			New and remapping	Revision
	1:24,000	1:31,680	1:62,500		
Alabama	372			372	
Arizona	30		1, 609	1, 283	356
Arkansas			1, 259	1, 027	232
California	2, 482		4, 842	6, 712	612
Colorado	1, 939		191	2, 130	
Connecticut		435		435	
Delaware					
District of Columbia					
Florida	123			123	
Georgia			750	750	
Idaho	484		630	1, 114	
Illinois			899	771	128
Indiana	859			827	32
Iowa			612	612	
Kansas	416		2, 907	2, 690	633
Kentucky	1, 978			1, 978	
Louisiana	843		1, 053	841	1, 055

***Areas, in square miles, mapped during fiscal year 1951 for publication on standard scales*—Continued**

[Contour intervals, 5 to 100 feet]

State	Scale			New and remapping	Revision
	1:24,000	1:31,680	1:62,500		
Maine			400	400	
Maryland	56			56	
Massachusetts		818			818
Michigan			242	242	
Minnesota	562		491	1,053	
Mississippi			1,006	251	755
Missouri	1,684		463	1,801	346
Montana	1,393		2,980	4,373	
Nebraska	1,554		2,807	4,361	
Nevada			932	932	
New Hampshire		116	98		214
New Jersey					
New Mexico					
New York	1,338			1,242	96
North Carolina	332		725	332	725
North Dakota	974		387	1,246	115
Ohio	5			5	
Oklahoma	61		742	803	
Oregon	83		1,023	1,106	
Pennsylvania	185			69	116
Rhode Island					
South Carolina					
South Dakota	2,758			2,758	
Tennessee	619			619	
Texas	463		1,810	1,854	419
Utah	1,022		86	1,108	
Vermont	20		110	130	
Virginia	471		2,005	1,117	1,359
Washington	136		1,870	2,006	
West Virginia	3			3	
Wisconsin	14		1,442	779	677
Wyoming	1,981		136	2,117	
Total	25,240	1,369	34,507	52,428	8,688
Alaska				[1] 298,743	

[1] Includes 28,823 square miles mapped on a scale of 1:63,360 and 269,920 square miles on a scale of 1:250,000.

A total of 815 topographic maps were reviewed and forwarded for reproduction by the photolithographic process.

In addition to new maps, the Division prepared reprint editions for 344 quadrangle maps, 14 State base maps, and 27 State index maps. At the close of the fiscal year, maps in process of reproduction included 16 for copperplate engraving and 250 for photolithography. Maps being reviewed or awaiting review by the editors at the close of the year totaled 63, with about 500 maps being carried on the agenda for reprinting.

About 20 percent of the maps cleared for reproduction were originally compiled by other agencies for administrative and other special-purpose use. Such maps, when judged suitable for general use, are edited and published by the Geological Survey for general distribution.

Special mapping and charting assignments were continued by the Trimetrogon Section for the United States Air Force. In general, these assignments, which are performed on a reimbursable basis, provided for the editorial review and evaluation of various charts and the preparation by photogrammetric methods of revised or recompiled base charts preliminary to photolithographic reproduction. Thi work forms an integral part of the over-all program of the Air Forc for the production and maintenance of adequate world-wide coverag of aeronautical charts, primarily in the interest of national defense

Approximately 225,000 square miles of entirely new photo compilation was completed, as well as photo revision of nearly 300,000 squar miles of charts and nearly 400,000 square miles of cartographic compilation—in all, approximately 925,000 square miles of charting. Covering areas in practically every part of the world, this involved total of 492 charts and various special projects as follows:

Preliminary charts on a scale of 1:250,000 (foreign)	2
Revision charts on a scale of 1:250,000 (foreign)	2
Preliminary charts on a scale of 1:250,000 (domestic)	
Shaded-relief charts on a scale of 1:250,000 (domestic)	
Pilotage and preliminary charts on a scale of 1:500,000 (foreign)	3
World aeronautical charts on a scale of 1:1,000,000 (foreign)	
Approach and landing chart on a scale of 1:250,000 (foreign)	
Charts on a scale of 1:100,000 (foreign)	2
Large-scale planimetric compilation	3
Special charts	1
Photo and cartographic revision, scale 1:200,000 (foreign)	1
Color-separation drafting	
Special drafting	43
Controlled photo mosaics, scale 1:48,000 (domestic)	94
Uncontrolled photo mosaics, scale 1:25,000 (foreign)	111
Overlays for mosaics, scale 1:25,000	34
Other projects	33

In addition, there were at the end of the year 309 charts in various stages of compilation, revision, or recompilation.

During the year, the Air Force assumed responsibility for the maintenance of the world-wide reference library containing several million oblique and vertical trimetrogon photographs. This library was formerly in the custody of the Trimetrogon Section.

The Special Maps Projects Section devoted its map-making facilities to the compilation and preparation for publication of State, sectional, and regional maps on scales of 1:250,000, 1:500,000, and 1:1,000,000.

For the United States portion of the International Map of the World, scale 1:1,000,000, three sheets—Austin (H–14), Mississippi Delta (H–15), and Cascade Range (L–10)—were published, and work already in progress on the Los Angeles (I–11) and Savannah (I–17) sheets was continued. The preparation of additional sheets of this series has been suspended.

Considerable progress was made on the Transportation Map of the United States, scale 1:250,000, being prepared for the Bureau of Public Roads. When completed for the 48 States this series, which shows the principal transportation routes, will comprise an aggregate of 441 sheets. New maps of this series were published for Nevada in 15 sheets, Ohio in 6 sheets, Louisiana in 9 sheets, and Alabama in 8 sheets. Compilation was advanced on sheets for Arkansas, Colorado, Kentucky, Mississippi, Missouri, and Tennessee.

In the new series of State maps, scale 1:500,000, both new base maps and topographic and shaded-relief editions (including one with highway overprint) were published for New Jersey, Maryland-Delaware, and Massachusetts-Rhode Island-Connecticut. Also published were 1:500,000-scale base maps in two editions (one with highway overprint) for Oklahoma, Indiana, Iowa, and Mississippi. Revision of the base maps of New Hampshire-Vermont, New Mexico, Ohio, and Pennsylvania was in progress.

Relief shading was completed on 25 maps. This is a part of the over-all program of publishing relief-shaded topographic maps of areas that have special physiographic interest. Among those completed were the shaded-relief maps of Chattanooga, Tenn., Great Smoky Mountains National Park and vicinity, and the Gunnison River Black Canyon National Monument.

Planning for National Defense

It appears that for a 6-year period the mapping facilities of the Topographic Division will be largely directed toward fulfilling the urgent requirements of the defense program. Mapping planned for this program is expected to reach its high point about the third year, after which more attention can be given to nonmilitary map requirements.

Particular attention was given during fiscal year 1951 to the planning of the mapping programs for the territories and possessions. For the mapping of Alaska close liaison is maintained between the Office of the Chief of Engineers, Department of Defense, and the Coast and Geodetic Survey of the Department of Commerce. Through coordinated efforts, plans have been formulated for the preliminary phases of a 5-year Alaska program designed to complete (1) a series of 1:250,000-scale maps of the entire Territory, (2) an inch-to-the-mile series of topographic maps of the strategic heartland of Alaska, and (3) maps which will meet certain high-priority civilian requirements in central and southeastern Alaska and which are considered essential for the economic development of the Territory.

Studies to determine the most economical and suitable methods for revising the maps of the Hawaiian Islands were completed. Field operations utilizing the results of these studies were started on Molokai, Maui, and Oahu, and the revision of the maps of the other islands will be undertaken during the next several years.

An analysis of the annual mapping requests of the principal Federal map-making agencies, as presented through the Bureau of the Budget, also was completed. Insofar as these requests were important to the defense effort, the mapping requested was integrated with the over-all program of mapping designed to meet national defense requirements.

Research and Development

The first part of the new manual which is being prepared to replace Bulletin 788 was published as Geological Survey Circular 92, containing Topographic Instructions, Chapter 1A1, Purpose and Use of Topographic Instructions, and Chapter 1A2, Table of Contents. Six other chapters issued in loose-leaf form were published during the year, the manuscripts for 39 chapters were in various stages of preparation, and outlines for 13 chapters were approved.

The classification of maps published between April 1950 and March 1951 was completed, and maps which had become out of date were reclassified. The numbered classification of all available quadrangle-map coverage, as well as the criteria used in the appraisal, has been coded and is being machine-tabulated. This tabulation is being reviewed to remove duplication and other errors, and a code is being added to permit segregation of duplicate map coverage, along with a column showing map area.

Development and testing of new methods of utilizing trimetrogon aerial photography continued. A 1° quadrangle in Nevada was in process of compilation from nine-lens P-K photography. As a study of the position accuracy of compilation with this type of photography, the quadrangle was compiled with slotted templets, and within the 1° quadrangle a 30-minute quadrangle is being compiled with a stereophotogrammetric plotter in an effort to determine its usability in preparing small-scale topographic maps. A 1° quadrangle in Idaho comprising an area of approximately 3,500 square miles was compiled to determine cost figures and the accuracy obtainable from trimetrogon photography for the 1:250,000-scale topographic map series. Experimental work to determine the feasibility of extending control for stereomapping with the photoalidade was completed on a project comprising six 15-minute quadrangles in southeastern Alaska. A Kelsh vertical stereoplotter was modified for use with oblique photographs, and a comparison was made with the oblique multiplex to explore the possibilities of such equipment in utilizing trimetrogon oblique photography.

Among the experimental projects for the improvement of topographic-mapping methods, photo mosaics were prepared and tested n field surveys for use as plane-table sheets for topographic-map ompilation. For this purpose, commercially sensitized foil-mounted aper was field-tested and found to be the most satisfactory material resently available. Additional tests of this method are planned for ext year.

The Wilson photoalidade was redesigned for use with glass plates s well as paper prints in conjunction with terrestrial and aerial blique photogrammetric mapping. A greater degree of accuracy s obtainable through the use of this method. By changing several arts, the new model can be made to accommodate photography of longer focal lengths as well as 9-by-18-inch photographs. The first f the newly designed alidades will be built during 1951.

Tests were made to determine the rigidity of surveying-instrument tripods, and the data compiled will be used to improve the specifications for future tripod procurement. A study was made of the effect of the sun's radiation on precise levels, and a special bubble assembly cover was designed which is expected to reduce the problems resulting from the nonuniform heating of the level caused by the sun. A system of testing and comparing altimeters in field surveys was investigated and improved. This system will have particular application to Alaskan mapping. A single-bulb contact printer was designed and constructed. The new printer provides for more rapid correction of variations in film density because of camera-lens limitations, resulting in improved print quality.

An experimental project was carried on in Alaska for extending vertical control toward the interior from the shore line. Horizontal positions of selected topographic features were plotted by multiplex, and a projection on glass cloth containing the plotted positions of some 50 features was used with the Wilson photoalidade in a procedure similar to plane tabling but using aerial oblique photographs for extending vertical control from shore-line points. This experimental technique was later used in supplemental-control activities in Hawaiian mapping. Low-altitude, high-oblique photographs were flown offshore, looking into the terrain so that the shore line was in the foreground and vertical control near the peaks could be identified in the distance. Supplemental elevations were then established by means of the new Wild-type photoalidade.

An experimental project for obtaining supplemental control was completed for an area in Uintah County, Utah, where mining and developing operations of commercial deposits of phosphate require large-scale maps. Supplemental control was obtained by phototransit, phototrig, and low-altitude aerial oblique methods, and three 7½-minute quadrangles were completed by multiplex with 20-foot contours. These methods promise to be especially useful in Alaska and in other remote areas not readily accessible for ground surveys.

Another experimental project for obtaining supplemental control was carried on in southeastern Alaska. Here the photoalidade technique was used with oblique photography for establishing supplemental control, and five inch-to-the-mile quadrangles with 100-foot contours were completed. These maps will be field-checked during the summer. Assistance was given two Economic Cooperative Administration projects in Brazil through the supervision of map compilation, including the preparation of specifications and the issuance of contracts. Reports on new instruments, mapping techniques, and methods were prepared and translated into Spanish for the Pan American Consultation on Cartography.

Geodetic Surveys

Geodetic surveys were carried on in the United States and Alaska to supply an adequate control framework for current topographic-mapping operations and for new mapping projects planned for the coming year. Data for these surveys were, for the most part, computed and adjusted in the regional offices immediately upon the completion of the field work and issued in processed lists giving all control information within a 15-minute quadrangle area. These lists were then available not only for Survey mapping operations but for the use of other Federal and State agencies as well as the public.

In addition to the basic-control surveys, supplemental-control surveys of the fourth order were made. These surveys, designed specifically for mapping operations, were made by plane table and stadia traverse, by various vertical-angle methods, by two-base altimetry, or by the mobile elevation meter.

The first attempt in the United States, so far as is known, to obtain ground elevations for topographic mapping by airborne electronic methods was made under contract in Alaska. With an instrument known as the Airborne Profile Recorder, approximately 78,000 square miles in central Alaska was surveyed from the air. A portion of the survey data was computed and adjusted and then analyzed by comparing the experimentally obtained data with test elevations determined by ground surveys. A subsequent test project has been started for the purpose of mapping the Big Delta, Alaska, quadrangle on a scale of 1:250,000 with a 200-foot contour interval to determine whether the new electronic method can produce satisfactory control for mapping that will meet standard accuracy specifications.

During the year, a field test was made of an experimental project in Wyoming involving a method of extending horizontal and vertical control concurrently by subtense base triangulation and simultaneous reciprocal vertical angles. Such control data were found to be satisfactory for mapping operations, and this method, when used in favorable locations, offers a saving in the over-all cost of basic control. Another test project was set up to evaluate the effect of signal color on refraction in vertical-angle measurement.

New tables and computing forms for machine computations of geodetic positions in triangulation and of elevations by vertical angles were designed. Also designed were new tables of M and P factors for machine computation of transit traverse. A simple mathematical test was developed for analyzing the strength of a three-point resection before making precise field observations.

Two sound-color training films, "Leveling for Topographic Mapping" and "Transit Traverse for Topographic Mapping," were produced for the orientation and training of new Survey employees. These films will also be made available to the military services, other Government agencies, engineering societies, and college groups.

Equipment was installed in the Central, Rocky Mountain, and Pacific regional offices for microfilming field notes and computations of current geodetic work. Microfilm records of the current geodetic work in the Atlantic region are made in Washington. Microfilming of the accumulated files of original field surveys and computation records in the Washington office has been practically completed.

Photogrammetry

The photogrammetric-mapping capacity of the regional offices has been substantially increased by the procurement and installation of additional multiplex equipment and Kelsh plotters of the latest design.

During the year contracts were awarded for approximately 160,000 square miles of new aerial photography in the United States, and approximately 100,000 square miles of this photography was completed. A contract for aerial photography covering the entire island of Puerto Rico (some 3,500 square miles) was awarded and completed. In addition, a sizable amount of aerial photography was obtained in cooperation with the Armed Forces.

Research and development projects for the improvement of photogrammetric equipment techniques, procedures, and instruments were carried on throughout the year. For the preparation of small-scale planimetric base maps, compilation work was undertaken and partly completed on an experimental mapping project utilizing aerial photography taken with a nine-lens camera. Also completed was the compilation of an experimental mapping project using the Twinplex, a new stereoplotting instrument developed by the Geological Survey. Field tests of this compilation are being made to determine the performance characteristics of this instrument.

Progress was made in the development of a new-type projector with an improved light source which is expected to increase the efficiency of existing types of stereoplotting instruments.

An improved type of diapositive printer, in which distortion compensation is achieved by the use of an aspherical correction plate in conjunction with an improved projection lens, was assembled and tested. An appreciable increase in image quality also was noted.

Experiments were undertaken in the use of oblique photography as an aid in establishing ground control. Two oblique-photography projects were completed, and two more were in progress. An experimental model of the Kelsh plotter, adapted for oblique photography, was built and tested. The tests revealed good possibilities for the application of this device to special mapping projects.

A distortion-free lens of high resolution was received from the manufacturer, installed in an aerial camera, and carefully calibrated. The photography obtained with this lens on test flights was found to excel in quality that obtained with any other wide-angle lens used in an aerial camera up to this time.

The increasing volume of photogrammetric activities, coupled with the high standards of precision required, have made it imperative that the Geological Survey expand the facilities of its optical laboratory so as to provide for the testing and calibration of precision photogrammetric cameras. The engineering design and the preparation of specifications for these improvements were completed, and steps were taken for the procurement of testing equipment, including a complete aerial camera calibrating device, a precision comparator, and various parts of a specially constructed photogrammetric optical bench.

Cartography and Map Editing

Most of the productive capacity of the Cartography and Map Editing Section was devoted to the technical control of map-finishing procedures. Special study was given to the determination of style, symbolization, and general quality of maps.

A considerable number of Corps of Engineers maps on military scales were prepared for reprinting for civil use, this conversion requiring changes in scale, headings, and other map detail. Improvements made in relief-shading techniques were utilized in the preparation of the new shaded-relief map of the Great Smoky Mountains National Park and vicinity. Current index maps for 37 States showing quadrangle names and locations, dates of survey, and series were prepared, as well as administrative planning maps for 10 States.

Work on map design and the improvement of drafting equipment and map-finishing procedures continued to be important. Printed maps were regularly inspected for factual content, legibility, and general appearance to determine where improvements might be made. During the year a standard scheme of map-paper sizes was established in order to facilitate the handling and filing of maps. A photolettering machine designed to expedite the preparation of type impressions and facilitate the development of improved type styles for maps was procured for the Denver regional office.

Symbol standardization was reviewed with other Government mapping agencies, and numerous changes were adopted. A survey of recent accomplishments and current activities in cartographic research and development was started. This survey should provide information of value to all cartographers and eliminate much duplication of effort in this field.

Map Information Office

The increased volume of service requests during the year gave evidence of the ever-expanding needs of Government and industry for maps and related data. A steady volume of requests came from Federal agencies, from exploration, geophysical-prospecting, and aerial-survey firms; from highway, railway, and airline organizations; from other map-making agencies, both governmental and commercial; and from engineers and technicians concerned with the construction of water supplies, sewage-treatment works, public-utility lines, industrial plants, and various conservation programs. In all, the office serviced approximately 30,000 requests.

The supplying of photographic and photostatic reproductions of new mapping in manuscript form (generally available a year prior to publication of the printed map), for engineering or other urgent technical needs, showed a substantial increase. Some 1,050 requisitions involving the processing of 11,000 prints were filled, with the total sales reaching $14,000, an increase of 50 percent over the preceding year. In addition, 7,200 prints were supplied without charge for the official use of Federal and State agencies.

The volume of requests for geodetic-control data continued to increase. For example, requests for horizontal and vertical control from oil-exploration and aerial-mapping companies involved the supplying of data for 1,700 quadrangles. In addition to supplying such data to other governmental agencies and to industry, the Map Information Office filled Geological Survey requisitions covering the basic control for 484 quadrangles to be used in mapping operations in the Atlantic region.

The more than 3,000 letters and telegrams regarding aerial photographic reproduction alone received this year gave indication of the extensive use of aerial photography, particularly for areas where topographic maps are not yet available and for special purposes in connection with geologic, mineral, and petroleum investigations, forestry operations, soil conservation and agricultural planning, highway construction, and many other activities.

The series of 14 base index maps of aerial photography was maintained in order to supply current information on Federal, State, and commercial holdings of aerial negatives. These maps show areas covered, date of photography, focal length of lens, and scale. Reproductions of the base maps are available to Federal and State agencies as well as to the public.

The sale of aerial photographic reproductions amounted to nearly $60,000, an increase of 15 percent over the previous year.

During 1951, map-information centers were established in Tulsa, Okla., and in Boston, Mass., so as to service directly the map requirements of intergovernmental groups concerned with natural-resource development. The Tulsa office supplies the Arkansas, Red, and White River Basin Inter-Agency Committee with map information needed in the preparation of a comprehensive report on the resources and development of the basin. The Boston office serves the New England-New York Inter-Agency Committee in a similar capacity.

The second edition of the index maps showing the status of topographic mapping in the United States was published during the year. These index maps classify topographic and planimetric maps published by the Geological Survey and other Federal agencies, thus keeping map users informed as to the quality of topographic-map coverage for specific areas and the new mapping in progress.

Topographic-map depository libraries and map-sales agencies in Missouri, Oklahoma, Texas, Mississippi, and Georgia were visited during the year in order to evaluate the use of topographic maps by the colleges and to determine procedures that might be adopted to make these map collections more readily available to all map users.

The preparation of special map displays was continued throughout the year. Displays on a State basis showing complete map, aerial photography, and control information, with illustrations of mapping procedures, selected shaded-relief maps, and other special data, were made for various State and university engineering groups. Other displays of particular interest to professional groups were assembled for the annual conventions of the American Association of Petroleum Geologists, St. Louis, the Association of the American Geographers, Chicago, and the American Society of Photogrammetry, Washington, D. C.

In cooperation with other Federal mapping agencies, the Map Information Office participated in presenting a 55-panel exhibit of maps and mapping methods at the annual convention of the American Congress on Surveying and Mapping. This exhibit, originally prepared for the meeting of the Pan American Institute of Geography and History in Buenos Aires, Argentina, has also been displayed in other countries in South America and in Europe as a part of the program for technical assistance and cooperation with other nations.

WATER RESOURCES DIVISION

Water is the Nation's most important natural resource. Because it is transient, it can be conserved only by using it wisely—it cannot be stockpiled like other resources. Fortunately, however, fresh water is a renewable resource. In streams and underground the supply is being replenished constantly through operation of the hydrologic cycle whereby water in the sea and on the land is transformed into vapor in the air and then is precipitated back upon the earth, purified. The process is continuous, but because the rate varies from time to time and from place to place, the water supply in any one locality is always changing. Streams rise and fall; flood follows drought or flood in an irregular pattern; the amount of water stored underground increases and decreases; and the quality of the water changes as it passes over and through the rocks, dissolving minerals from them and picking up its load of sediment. We must keep records of these never-ending changes so that we can know what our water resources are. The collection, compilation, and interpretation of those records is the major work of the Water Resources Division.

All the water we use comes from rainfall. Generally, however, only a small part of the rainfall remains on or in the earth long enough for man to put it to work; evaporation and transpiration take their toll first. Thus, although the amount of rainfall may vary within narrow limits from year to year, the portion available for replenishing a water supply may vary widely, as it is what remains after the relatively constant demands of evaporation and transpiration have been satisfied. Predictions of future water supplies are rarely made for longer periods than the time required for the water to run off after it has already been precipitated on the earth. Accurate estimates of runoff are possible only where there are many years of records collected by the Geological Survey on which to base them; such records are essential for planning long-range programs or making dependable short-term predictions. In a national emergency, however, owing to sudden requirements that could not be anticipated in a stable economy, estimates of water supplies are frequently based on meager specific data. The only justification for such estimates is that the need offsets the risk. Although the men who make them have had years of experience in interpreting similar records, it would be uneconomical to rely on them in designing peacetime installations.

The Nation's water supplies, which have been subject to record-breaking demands in the past, are being used at accelerated rates during the present period of mobilization. Although water is a renewable resource, there are indications of a sudden awareness that the Nation's waters are a limited resource. This limitation on the amount of water available produces many problems in various phases of our expanding economy. Industries need water for the enlargement of existing facilities or the establishment of plants at new locations. Increasing population calls for more water for domestic use. With irrigation growing within arid regions and spreading into humid areas to assure crop production in times of drought, it is becoming increasingly difficult to meet all the demands for water. Only through the systematic and continuing inventory of our water supplies are we able to make the most efficient use of the available water.

Federal Government's Interest in Water Resources

The problems of water supply and utilization affect such large areas and such wide interests that they are more and more becoming problems of national concern. Therefore, the collection of information on water resources is a definite obligation of the Federal Government, in close collaboration with all State and local agencies concerned.

During recent years it has become evident that, in addition to determining the occurrence and availability of water, the Geological Survey must also determine the extent and methods used in developing supplies, utilization, and conservation in areas where the limits of readily available supplies apparently are being reached. A first step in this direction is the determination of the water requirements of various classes of users. During the latter part of fiscal year 1950 a unit was established in the Water Resources Division to investigate the quantity and quality of water required for producing various manufactured products and to assist in the planning and preparation of reports on the water resources of specific areas.

During fiscal year 1951, a report was prepared on the estimated use of water in the United States during 1950. The report showed that the withdrawal of water from streams, lakes, and underground formations was about 170,000 million gallons per day, exclusive of water used for development of water power. The average daily use of water from municipal systems was 145 gallons per person. An average of 3,600 million gallons per day was used for rural domestic and stock supply. Industry used an average of 77,000 million gallons per day from private sources, including some brackish water. Eighty-nine million acre-feet of water was delivered to irrigators during 1950, and 1,250 million acre-feet was used for the generation of water power.

Information has been collected on the quantity of water required to produce a given unit of production, the chemical content of water permissible for certain industries, and the variation in the manner in which water is applied within a manufacturing or mining process. Information obtained from industrial plants has revealed that the basic industries producing the initial materials for later fabrication—such as steel, gasoline, rubber, plastics, and paper—require the greatest volume of water both for the individual plant and for a given tonnage or unit of production. On the other hand, the fabrication processes—such as stamping, cutting, and assembling—require much less water, in some plants little more than that used by the workers for sanitary purposes. Typical quantities of water required per unit of production are: steel, 60,000 gallons per ton; rayon, 200,000 gallons per ton; and paper, 65,000 gallons per ton. The large industrial plants producing basic raw material likewise have greater difficulty in providing water with the necessary chemical quality and temperature. This is due partly to the large quantities involved but more particularly to the wide variety of uses to which the water is applied in industry. The requirements with respect to dissolved minerals range from a high degree of purity for pharmaceuticals, foods, electroplating solutions, rayon, and the like to few or no restrictions for washing and cooling operations that may permit the use of most natural waters, possibly including even sea water. Most significant has been the observation that, within limits, the water system for an industrial plant is dictated largely by economic and geographic circumstances and hence varies considerably from plant to plant. For example, a paper mill located in an area where sufficient water is available may make high-quality thin paper by means of the bleached sulfate process and use more than 100,000 gallons of water per ton of finished product. On the other hand, a paper mill in an area where large amounts of water are not available may produce newsprint from pulpwood with a total water requirement of less than 15,000 gallons per ton of product.

The Federal Government is itself a large user of water-resources information. For example, in the Columbia and Missouri River basins where water-development projects are being carried out and great multiple-purpose dams are being built and operated, extensive and accurate water-resources information is essential for economic design and operation. The choice of site for the reservoirs connected with these projects presents an efficiency problem; some reservoir sites are unusable because evaporation from their surface would be so great that there would be little water left for beneficial use. Because more accurate information is needed on the amount of evaporation from reservoirs, the Geological Survey, in cooperation with the Bureau of Reclamation and the Department of the Navy, began a comprehensive investigation of evaporation at Lake Hefner, near Oklahoma City. The studies there have shown already the practicability of new methods of determining evaporation from reservoirs. The results of these studies will be applied to larger reservoirs such as Lake Mead and also to new research on the problem of determining the amount of water wasted by bottom-land vegetation.

Water information is also used by the Federal Government in providing supplies on the public domain for watering stock. The Geological Survey cooperates with the land agencies of the Department in the conservation of the soil and water resources of the public domain and of Indian lands in the 17 Western States. Most of the land is semiarid or arid, and water is the key resource in its utilization and development. New supplies of water from wells, springs, or ponds, developed on the basis of exploration by the Geological Survey at the request of the land agency in charge, have brought tens of thousands of acres of land into grazing use for the first time. In many other areas old and uncertain supplies have been improved. Besides increasing the value of the land, evenly distributed water supplies reduce the concentration of grazing loads at a few watering places and so retard erosion.

Information on erosion and sedimentation is highly important to the Federal Government. Many formerly productive valleys have been and are being destroyed by systems of large gullies; not only do the gullies impair these valley lands for grazing and irrigation, but they drain away the shallow ground water and they are large sources of the sediment loads carried by the rivers into the reservoirs. Studies in progress by Survey scientists as to the causes of this destructive and, in some places, critical erosion are producing a better understanding of the effects of rainfall, vegetation, soil properties, and land use on rates of erosion and sedimentation. The results are being analyzed for use in developing methods of arresting the erosion.

The Federal Power Commission requires licensees operating hydroelectric projects to measure the flow of streams used to generate power. The Geological Survey supervised stream gaging on 150 licensed projects during 1951 at the request of the Commission.

During 1951 Fedral agencies made available more than $3,200,000, by transfer or reimbursement, to provide for investigations to be made by the Geological Survey, because the Survey's direct appropriations did not permit the collection of the amount of water data required for Federal water-development projects. These Federal agencies include the Bonneville Power Administration, Bureau of

Reclamation, Bureau of Indian Affairs, Fish and Wildlife Service, National Park Service, Soil Conservation Service, Forest Service, Weather Bureau, Department of the Army, Department of the Navy, Department of the Air Force, Department of State, Department of Justice, Tennessee Valley Authority, Atomic Energy Commission, Reconstruction Finance Corporation, and Veterans' Administration.

Cooperation With States and Municipalities

Most of the water-resources investigations of the Geological Survey are made in cooperation with States and municipalities. The information on water supplies collected by the Geological Survey benefits all and is available to all, yet it is so important to State and local governments that they have long supplemented Federal appropriations to carry on these investigations. Through the years, the funds offered by local governments for cooperation with the Geological Survey have usually exceeded the funds regularly appropriated to the Survey for cooperative work. The appropriation for cooperative work in 1951 was $3,068,000. The amounts available for cooperation in fiscal year 1951 in each State and territory were:

State:	*Obligations*
Alabama	$36,462
Arizona	78,144
Arkansas	50,284
California	266,143
Colorado	76,600
Connecticut	16,205
Delaware	16,015
Florida	103,250
Georgia	38,035
Idaho	33,576
Illinois	65,045
Indiana	75,233
Iowa	62,739
Kansas	47,951
Kentucky	102,380
Louisiana	69,111
Maine	8,999
Maryland	58,578
Massachusetts	34,055
Michigan	48,402
Minnesota	26,722
Mississippi	11,391
Missouri	43,326
Montana	34,914
Nebraska	54,812
Nevada	$43,083
New Hampshire	10,910
New Jersey	62,224
New Mexico	87,509
New York	141,197
North Carolina	46,247
North Dakota	30,872
Ohio	112,076
Oklahoma	75,002
Oregon	75,858
Pennsylvania	128,957
Rhode Island	7,268
South Carolina	19,836
South Dakota	6,673
Tennessee	73,363
Texas	334,333
Utah	99,096
Vermont	6,921
Virginia	91,790
Washington	130,992
West Virginia	24,857
Wisconsin	26,096
Wyoming	26,236
Hawaii	70,397
Total	3,190,145

Funds aggregating nearly $11,500,000 were obligated for water investigations in the fiscal year 1951. Of that amount, about 45 percent was appropriated directly to the Geological Survey by the Congress, 27 percent was contributed by States and municipalities, and about 28 percent was provided by other Federal agencies.

Field Offices

In 1951 the water-investigations work was conducted from more than 120 principal field offices, with one or more strategically located in nearly every State and in the Territories of Alaska and Hawaii. This decentralization results in a high degree of efficiency and economy of work and in better service to the public. Close contacts are maintained with local Federal, State, and municipal officials, and the interests of cooperating agencies are served. The Survey's field offices are local sources of information as to available water resources, fluctuating stage and discharge of surface streams, fluctuations of the water table, and the chemical and physical quality of surface and ground waters.

Although the water-resources investigations are conducted along three lines—surface water, ground water, and quality of water—for operational purposes and for reporting, the activities are so interrelated that only by giving comprehensive attention to all three can a balanced water-resources investigation be made.

Surface Water

The year 1951 was one of continued increase in the demands for base stream-flow data. Information in regard to stream-flow characteristics was an important factor in the selection of several sites for new atomic-energy plants. About 100 gaging stations were added during the year, so that the total number of gaging stations now in operation in the United States and in the Territories of Alaska and Hawaii is well over 6,300. The stations were operated in 1951 through 44 district offices in cooperation with 160 agencies of State and political subdivisions and with 14 Federal agencies. Detailed records of discharge for these gaging stations were computed and published in the annual series of water-supply papers entitled Surface Water Supply of the United States.

The stream-gaging program in Alaska has been steadily expanding since it was reactivated in 1947 with the establishment of seven gaging stations. At the end of 1951, a total of 52 gaging stations were in operation and several more were under construction. Occasional measurements of discharge are collected at other locations.

Flood-frequency analyses were in progress in several districts; one district completed its studies during the year, and the results were published as a Geological Survey circular. Several flood reports were being prepared for publication as part of a series on floods of 1950. Several districts were conducting studies of low-flow characteristics of small, ungaged streams by correlation with adjacent gaged streams on the basis of simultaneous discharge measurements. The verification of discharge as determined by slope-area and other indirect methods, a program begun in 1949, was continued in 1951. Progress was made on a program conducted in close cooperation with the Bureau of Public Roads and various State highway departments to promote greater use of stream-flow records in solving hydraulic and hydrologic problems connected with highway structures.

The report on the effect of backwater on the determination of the discharge of rivers, prepared in 1949, was revised on the basis of further analysis. A report on factors influencing water levels in ponds in limestone sinks in southwestern Georgia was completed. Two reports pertaining to stream flow in the Missouri River Basin were prepared and published as Geological Survey circulars. In addition, seven project-type cooperative reports were completed and transmitted to the cooperating State agencies for publication.

New items of equipment were developed in the equipment laboratory to improve the accuracy of, or to expedite, current-meter measurements. Of particular note are a special current meter for measuring steams under ice cover; the B–50 reel, which features a depth indicator that automatically computes the meter setting; and a crane mounted on a jeep, with power take-off from the jeep motor.

Ground Water

Continued intense interest in, and accelerated development of, ground water characterized fiscal year 1951. As in World War II, an increasing proportion of ground-water investigations related to defense activities at some sacrifice to the nondefense investigations that had been under way. Fortunately, however, most of the defense-type investigations result in data that will be useful in future projects, and many of them involve expanded research resulting in improved techniques applicable to ground-water problems of all types.

An important example is the sonic method of depth measurement that is being developed in cooperation with several other agencies. The method, previously limited to measuring the depth of water bodies, is being adapted successfully to the determination of the thickness of various earth materials and rock formations. It promises to be an exceedingly useful supplement to existing earth-resistivity and seismic geophysical methods of extending the results of test drilling.

Research was extended during the year on the use of underground reservoirs for waste disposal as related to both radioactive materials and other waste products such as spent brines. Disposal of such materials into water-bearing formations that contain salt water or that are unusable for other reasons represents the most economical method in many areas. However, intensive study in each area is required to determine how the recharge wells must be constructed and operated for continued effectiveness and to obtain assurance that the disposal will not affect usable water supplies or have other deleterious effects, even in the distant future.

The study of microfossils from wells near the Brookhaven National Laboratory on Long Island, N. Y., led to important conclusions as to the character and continuity of the containing clay stratum, a matter of considerable importance in evaluating the recharge of and hence the dependability of the water supply of the sand and gravel under the clay, and also of importance in relation to disposal of radioactive wastes.

Studies of mine-drainage problems, on which pioneer work was done in Michigan several years ago, were expanded there and begun in Minnesota, Tennessee, and Arkansas. Fundamental research on the movement of water in and adjacent to ore-bearing formations gives promise of cheaper and more effective methods of mine unwatering and thus of exploiting ores that cannot be worked economically at present.

A research project on the relation of ground-water recharge and stream flow to soil and vegetal conditions was started in New Jersey, and a similar project is just beginning in New York. This field is one of great practical importance and one in which much remains to be done.

A paper was prepared on the use of cyclic fluctuations of water levels in observation wells, such as those caused by ocean tides, in computing the hydraulic properties of water-bearing formations. These computations previously had been based largely on analysis of data gathered in controlled pumping tests of wells. A technique involving similar principles was developed for computing hydraulic properties from the results of bailing tests made in wells where the depth to water or the cost involved precludes making conventional pumping tests. The technique was developed in a bailing test of a well in Arizona where the water level was more than 1,000 feet below the surface.

A report on Seneca County, N. Y., confirmed the suspected northward extension of buried, drift-filled valleys now occupied by two of the Finger Lakes. The buried extensions contain water-bearing glacial deposits, so that their existence is a matter of practical importance as well as geologic interest. Studies in west-central Ohio resulted in substantial revision of the then current conception of the pattern of buried preglacial valleys.

Advances were made in equipment development. A set of compact, lightweight electrical well-logging instruments, developed during the last few years, was adapted for truck mounting. Several of the instruments composing the set are of a design that is expected to be particularly useful in ground-water studies. A sensitive electrical temperature-measuring instrument was adapted for showing the direction and velocity of movement of water in drilled wells. This instrument will supplement the deep-well current meter, inasmuch as its small size will permit its use in wells having only small access openings and in some wells equipped with pumps. An electrical tape gage was developed that depends on completion of an electrical current between dissimilar metals when the electrode makes contacts with the water in a well. The fact that the instrument does not require batteries gives it an advantage over existing electrical tapes.

Work by ground-water hydrologists in foreign countries continued at the request of those countries or other agencies, with projects in Saudi Arabia, Greece, India, and Japan. The flow of foreign hydrologists to this country for training in methods of ground-water study likewise continued; India, Japan, the Union of South Africa, Canada, Haiti, and other nations were represented.

During fiscal year 1951, ground-water investigations were made on more than 400 projects in the United States, Hawaii, Puerto Rico, the Virgin Islands, and Alaska. The studies were made through 37 district offices in financial cooperation with 88 State, county, and municipal agencies and 8 Federal agencies. More than 200 formal reports and papers were prepared, and several thousand requests for information on ground water were answered.

Quality of Water

An integral part of the change water undergoes in its progress through the hydrologic cycle is the persistent alteration in the chemical quality. The type of material with which the water has been in contact and the length of time in contact governs the degree of mineralization and ultimately the use of the water. Water of unsuitable quality will affect adversely every phase of human living.

The growing number of chemical analyses made of the Nation's water resources provides a storehouse of factual information. During fiscal year 1951, the chemical quality of nearly 50,000 samples of water was determined in 13 laboratories located in Washington, D. C., and throughout the country. One such laboratory was established during the year at Davis, Calif., to handle the State cooperative work. Other cooperative investigations of the chemical quality of ground and surface waters were in progress in Arkansas, Colorado, Delaware, Florida, Iowa, Kentucky, Louisana, New Mexico, North Carolina, Ohio, Oklahoma, Pennsylvania, South Carolina, Texas, Utah, and Virginia. Surface-water samples were collected daily at 215 stations on streams for chemical analysis in connection with these programs. Thirty-three daily sampling stations were established as Federal network stations on Western streams to follow trends in mineral content in order to insure continued successful operation of existing irrigation projects. In addition, samples were collected on an intermittent basis at 145 stream-sampling sites. Samples were also collected and analyzed for cooperative studies of ground water in other States. Data concerning the larger municipal water supplies throughout the country are being assembled, and analyses have been made by all laboratories to culminate in an over-all report on the chemical characteristics of the public water supplies of the United States.

Quality-of-water data concerning the use of water for national defense, public health, agriculture, industry, and recreation are essential in sound development of Federal projects and the protection of Federal property. Analytical results, intrepretation of analyses, or advice about water problems was furnished to the following Federal agencies: Atomic Energy Commission, Department of the Navy, Department of the Army, Department of the Air Force, Public Health Service, Veterans' Administration, Bureau of Reclamation, Bureau of Mines, Public Housing Administration, Federal Works Agency, and Fish and Wildlife Service. During fiscal year 1951 about 4,000 analyses were made at the request of the above-mentioned agencies; nearly 700 of these were analyses of samples collected at defense installations in this country and at offshore bases.

The importance of measuring the large quantities of sediment transported by the rivers of the Nation is rapidly becoming more widely recognized. The demand for the construction of large dams to impound greater quantities of water in reservoirs for irrigation, power development, and industrial use has focused attention on the probable useful life of these reservoirs. As the greater part of the sediment carried in streams is dropped in the reservoirs, it is essential that systematic studies be made to determine the quantities of sediment that will have to be taken into account in the construction of the dams and the operation of the reservoirs.

Sediment-measure studies of the Geological Survey were extended to include new cooperative programs in Ohio and Virginia during the year. Sediment samples were collected daily or more frequently at 148 stations, largely in the Rio Grande, Colo., Schuylkill (Pa.), and Missouri River Basins with a few stations scattered in Delaware, Kentucky, North Carolina, Oklahoma, Ohio, Texas, and Virginia. Eight of the stations were established as Federal index stations to evaluate rates of sediment production in areas where no studies have been made; one each is in New Mexico, Texas, North Carolina, Kentucky, Ohio, and Virginia, and two are in Pennsylvania. In addition, miscellaneous sediment samples were collected on an intermittent basis at 39 sites in these river basins and States. In all, more than 125,000 sediment samples were collected and analyzed during the year in 14 laboratories throughout the country.

Missouri River Basin

The coordinated projects of the Bureau of Reclamation and the Corps of Engineers for the development of the Missouri River Basin require extensive water investigations. These investigations are generally conducted in cooperation with States and municipalities. Additional activities to meet the needs of the departmental program include measurements at 261 stream-gaging stations; 67 projects related to ground-water supplies or to changes in ground-water conditions that may result from reservoir construction or irrigation in the vicinity of reclamation units; more than 60,000 measurements of the sediment content of surface waters at 77 regular stations and 34 stations for miscellaneous measurements; 6,000 analyses of the chemical quality of the waters at 23 regular stations and at 60 stations for miscellaneous records; 1,200 chemical analyses of ground waters from various sources; and hydrologic and utilization studies related to the proposed plans of development. The information obtained through these investigations is furnished to the interested agencies currently or periodically.

Interstate Compacts

Interstate compacts providing for the division between States of waters of interstate streams and authorizing or requiring the establishment and operation of gaging stations, generally by the Geological Survey, are now in effect as follows: Colorado River (Wyo., Utah, Colo., N. Mex., Ariz., Nev., Calif.), Upper Colorado River (Wyo., Utah, Colo., N. Mex., Ariz.), Belle Fourche River (Wyo., S. Dak.), Republican River (Nebr., Kans.), Rio Grande (Colo., N. Mex.), Costilla Creek (Colo., N. Mex.), Cheyenne River (S. Dak., Wyo.), Pecos River (N. Mex., Tex.), Arkansas River (Colo., Kans.), Snake River (Idaho, Wyo.), and Canadian River (N. Mex., Tex., Okla.). Similar compacts are in process of negotiation for the Yellowstone River (Mont., N. Dak., Wyo.) and the Bear River (Idaho, Utah, Wyo.).

International Treaties

International problems related to water are increasing. The Geological Survey, using funds transferred by the Department of State, makes the water-resources investigations along the Canadian boundary that are required by orders issued by the International Joint Commission, United States and Canada, under the treaty of January 11, 1909. In addition to these continuing investigations needed for division and control of waters along the international boundary, several special investigations were made in 1951 in connection with references before the Commission, particularly those relating to the Columbia River Basin, Sage Creek and the Waterton and Belly Rivers in Montana, the Souris and Red Rivers in North Dakota and Minnesota, and the St. John River in Maine. The Geological Survey, through agreement with the Department of State, has continuing obligations for obtaining water-resources information along the Mexican boundary as required by the Mexican water treaty of 1944. Members of the Geological Survey serve on several international engineering boards.

Reports on Investigations

The results of the varied studies and computations made by the Water Resources Division are made available for public inspection as soon as practicable by placing manuscript copies of observations, measurements, chemical analyses, and interpretative reports in the open files of the district offices concerned. The availability of this information is made known through public announcements. Streamflow and ground-water conditions in the United States and Canada are summarized monthly and semiannually in the Water Resources Review.

The published work of the Water Resources Division during the fiscal year 1951 consisted of 29 new water-supply papers, a large number of shorter reports in the technical press, and 61 reports transmitted for publication by cooperating State agencies. In addition, a number of miscellaneous processed reports were issued.

CONSERVATION DIVISION

The Conservation Division classifies the Federal lands as to mineral and water resources and supervises mineral-recovery operations under leases, permits, and licenses on Federal, Indian, and naval petroleum reserve lands. A small headquarters staff and a field staff of competent geologists and engineers are maintained. This force makes field surveys, prepares maps and reports dealing with water power, fuels, minerals, and chemicals essential to the mineral-resource economy of the United States, and conducts on-site supervision of mining and drilling operations necessary to assure the safe and economical production by private enterprise of coal, oil, gas, and other minerals.

Mineral Classification

All phases of the service rendered by the Mineral Classification Branch were maintained at an active pace throughout fiscal year 1951. In all, some 16,600 cases involving either the outright disposal of Federal lands with no reservation of any mineral, the disposal of such lands with the reservation of one or more specified minerals, or the exercise under the Federal leasing laws of the Government's right to explore for and produce one or another mineral substance from lands under its jurisdiction were acted upon during the year. This represents an increase of about 5 percent as compared with 1950, reflecting increased public interest in the acquisition of Federal lands for settlement under the desert-land laws, for use under the public-sale laws, and for oil and gas prospecting and development under the mineral-leasing laws. This increase was more than sufficient to offset a concurrent decrease in applications concerned with coal, phosphate, potassium, and sodium. In addition, the Branch prepared and promulgated initial or revised definitions of the known geologic structure of 15 producing oil and gas fields containing Federal land and revoked two such definitions; appraised geologically 139 unit-plan or participating-area submissions; drafted or approved 87 determinations of leasehold relations to the productive limits of oil and gas deposits as found to exist on August 8, 1946; reported for appropriate administrative action the fact and geologic significance of 126 new discoveries of oil or gas made on or affecting Federal-land leaseholds; and prepared six mineral-advisory reports on properties in process of disposal by the Federal Security Agency.

From field offices in Colorado, Wyoming, Montana, Utah, California, New Mexico, and Oklahoma, Branch geologists made numerous "spot" investigations which resulted in geologic reports and maps for official use in the Mineral Classification Branch, other branches of the Conservation Division, other bureaus of the Department, and the National Military Establishment. Noteworthy were completed reports on the coal resources of the Dickinson Reservoir area, Stark County, N. Dak.; on the oil resources of the Huntington Beach tideland area, Orange County, Calif.; on the oil potentialities of the Fishtail Creek area, Stillwater County, and a part of the Marias River Valley, Toole and Liberty Counties, Mont.; and on three dam sites near Lake City, Hinsdale County, Colo., and seven dam sites on the Cowlitz River and its tributaries, Lewis and Cowlitz Counties, Wash.

Water and Power Classification

The field work of the Water and Power Branch during 1951 was directed mainly toward obtaining basic information on the water-power resources and storage possibilities of Federal lands on which projects were proposed for early development. Work was done in Alaska and New Mexico and in the Colorado and Columbia River basins. Topographic surveys were made of 4 reservoir sites, 11 dam sites, and 122 miles of river channel. The Branch supervised the construction and operation of 134 power projects under licenses with the Federal Power Commission, 512 such projects under permit or grant from the Department of the Interior, and 192 in cooperation with the Bureau of Indian Affairs.

Classification activities resulted in the addition of 17,714 acres to power-site reserves and the elimination of 14,270 acres, increasing the outstanding reserves in 23 States and Alaska to a net total of 6,851,062 acres.

Maps published covered 70 miles of stream channel on five rivers, nine dam sites, and two reservoir sites.

Final action involving hydraulic determination was taken on 734 cases received from departmental sources and the Federal Power Commission and on 4,423 cases that also involved mineral classification.

Investigations were in progress on the power and water-storage possibilities of 32 rivers. Six reports on the power possibilities of streams and three reports on dam and reservoir sites were completed. Four of the reports have been made available for public inspection.

Mining Branch

The Mining Branch is responsible for the supervision of operations concerned with the discovery and production of numerous minerals from leases on acquired, Indian, and public lands. Minerals produced under such outstanding leases include copper, manganese, uranium, asbestos, limestone, gravel, coal, sand, marble, silica rock, iron, gypsum, vermiculite, pumice, clay, fluorspar, feldspar, lead, zinc, barite, mica, tungsten, and garnet.

The Branch is charged with the responsibility of reporting on applications for leases and prospecting permits; recommending lease terms; enforcing regulations and lease terms governing the conduct of prospecting, mining, and beneficiation operations and the safety and welfare of employees; protecting natural resources and preventing waste; determining the royalty liability of lessees and permittees; preparing statements of accounts; and receiving payment of royalties and rentals. The Branch acts in an advisory capacity to the Secretary and to other bureaus of the Department in the handling of leases, permits, and licenses.

As of June 30, 1951, the Branch was supervising 1,250 properties under leases, permits, and licenses, of which 906 were on the public domain, 92 on acquired lands, and 252 on Indian lands. These properties involved lands in 17 States west of the Mississippi River, 12 Eastern States, and Alaska. Production from lands under supervision during the year is estimated at 19,133,000 tons, valued at $106,735,000, with accrued royalties amounting to $3,844,000, as compared to a production of 13,674,550 tons, valued at $89,256,553, with royalties of $2,887,661, during the previous fiscal year.

The production of coal from public lands in the United States and Alaska, including the former Chickasaw-Choctaw segregated coal lands in Oklahoma purchased by the Government from the Indian owners on May 1, 1949, was approximately 8,946,000 tons, as compared with 7,459,000 tons mined during the previous fiscal year from the same lands. The increase was achieved in the face of increased competition from other fuels and reflects the increased industrial tempo.

Potassium production is estimated at 5,393,000 tons of salts, as compared with an actual production of 4,422,892 tons during the fiscal year ended June 30, 1950, and 4,952,930 tons during the fiscal year ended June 30, 1949. The decrease during 1950 was due to the prolonged strike of the potash-mine workers in New Mexico; the 1951 production reflects a return to normal conditions. Two new operations in the New Mexico area are in the initial stages of development; one is expected to start production late in 1951 and the other early in 1952, representing an estimated additional 1 to 1½ million tons annual capacity. Seventy-three core tests were completed during the fiscal year, resulting in a substantial increase in indicated reserves. The number of potassium permits in effect in all States on June 30, 1951, was 244 as compared to 270 on June 30, 1950.

The principal source of sodium from public lands is the Searles Lake brine deposits in California. Refined salts produced from these brines under the provisions of potassium leases include potassium chloride, borax, soda ash, salt cake, bromine, burkite, and sodium lithium phosphate. During the year, operations under 94 sodium-prospecting permits were supervised in the States of California, Nevada, New Mexico, North Dakota, Oregon, Utah, and Wyoming. Westvaco, now operating on Government and adjoining Union Pacific

Railroad lands near Green River, Wyo., is at present considering the construction of a refinery at a cost of $10,000,000.

Phosphate leases on public lands in Arizona, Idaho, Montana, and Wyoming, increased from 29 to 33 during the fiscal year. In addition, there are 33 phosphate leases on Indian lands in Idaho and 1 phosphate lease on acquired lands in Florida. The total phosphate-ore production decreased from 514,369 tons in 1950 to 479,181 tons in fiscal year 1951. Surplus stocks of phosphate rock which had accumulated at Trail, British Columbia, account for the decline in the production from mines on public lands in Montana from 263,500 tons during 1950 to 69,900 tons during 1951. With the completion of a third electric furnace at Pocatello, and of another at Silver Bow, Mont., the potential output of elemental phosphorus in the Western States will be doubled early in the coming fiscal year.

The production of lead and zinc concentrates from Quapaw Indian lands in Oklahoma will approximate the 47,863 tons produced during fiscal year 1950. The tonnage of ore mined is greater, but the grade of the ore is slightly lower. A substantial tonnage of uranium-vanadium ores was mined from Indian lands in Arizona, New Mexico, and Utah.

Coal, fluorspar, quartzite, sandstone, bentonite, and feldspar accounted for most of the production from acquired lands. A phosphate lease for the development of a coloidal phosphate deposit in Florida and manganese-clay leases involving acquired lands in Tennessee were issued during the year. Wide interest is being shown in coal deposits on acquired lands in Ohio, Virginia, Kentucky, and Alabama.

A total of 84 awards for achievement in safety of mine operation were made in 1950 by the Joseph A. Holmes Safety Association to coal mines in the United States; 11 of the mines cited were west of the Mississippi, and of these, 5 were on Government land. In the industrial-minerals group, one out of six awards was received by a potassium lessee. The Sentinels of Safety award for bituminous coal mines, given to a single industrial group each year, has been made to one lessee 12 times out of 18 since the mine was entered in the competition. These awards for safety achievement bear witness to the cooperation of mine management and employees in the conduct of safe mine operations on Government land.

Oil and Gas Leasing

The Oil and Gas Leasing Branch supervises operations for the discovery, development, and production of crude oil, natural gas, and products extracted from natural gas on public, acquired, and Indian lands. These duties were carried out during the year by means of

21 field offices and suboffices in California, Colorado, Montana, New Mexico, Oklahoma, Utah, and Wyoming.

On the public lands 38,916 oil and gas properties were under supervision at the end of the fiscal year, aggregating 29,776,704 acres in 22 States and Alaska, an increase of 34½ percent in the number of properties and 26½ percent in the acreage under supervision at the close of the previous fiscal year.

Drilling on public lands during the year included the spudding of 1,039 wells and the completion of 974 wells, of which 666 were productive of oil and gas and 308 were barren. In all, 15,449 wells, including 9,125 capable of oil and gas production, were under supervision on June 30, 1951. The production from petroleum deposits on the public lands during 1951 was substantially greater than during 1950. Production from the public lands during fiscal year 1951 amounted to about 89,650,000 barrels of petroleum, 137,265,000,000 cubic feet of natural gas, and 160,178,000 gallons of gasoline and butane, with royalty returns to the United States of approximately $25,752,000.

Drilling on acquired lands during the year included the spudding of 68 wells and the completion of 66 wells, 38 of which were productive of oil or gas and 28 of which were barren. In all, 185 acquired-land wells, including 135 capable of oil or gas production, were under supervision on June 30, 1951. The production from acquired lands during fiscal year 1951 amounted to about 2,484,000 barrels of petroleum, 550,000,000 cubic feet of natural gas, and 1,036,000 gallons of gasoline and butane, with royalty returns of approximately $724,000 during the year.

The Branch supervised operations on 7,040 leaseholds on Indian lands in 14 States, which contained at the end of the year a total of 8,502 wells, 4,151 of which were productive of oil or gas and 318 of which had been completed during the year. The total revenue from royalties, rentals, and bonuses amounted to $8,304,000.

On behalf of the Department of the Navy, supervision was continued in 1951 over the production of oil, gas, gasoline, and butane from 19 properties under lease in Naval Petroleum Reserve No. 2 in California. Production from 258 active wells in this reserve aggregated 2,615,000 barrels of petroleum, 1,087,000,000 cubic feet of natural gas, and 7,483,000 gallons of natural gasoline and butane, with an aggregate royalty value of $913,340.

On Department of the Army lands in the Rio Vista gas field, the work included the consideration and approval of numerous revisions in participating percentages and the computation of royalties due the United States. The gas production allocated to the lands was 4,125,000,000 cubic feet, with a royalty value of $379,745.

Activities leading to the unitization of oil and gas operations involving Federal land were reflected in the approval of 24 new unit plans during the year and the termination of 27 previously approved unit plans, leaving 178 approved plans, covering 2,492,862 acres, outstanding on June 30, 1951. About 59 percent of the petroleum obtained from public lands during the year was produced under approved unit agreements, as well as 45 percent of the natural gas and 71 percent of the gasoline and butane. In addition, two Indian-land unit agreements covering 3,430 acres were approved during the year, leaving five such approved plans covering 36,066 acres outstanding on June 30, 1951. Also, 29 drilling-unit agreements were approved during the year, making a total of 133 approved as of June 30, 1951. These agreements involve isolated small tracts which are consolidated to form a logical drilling unit; in effect, they constitute an agreement similar to a unit agreement, although they involve only a small segment of a single field or pool.

WORK ON PUBLICATIONS

Texts

During the year 174 new manuscripts were received by the Section of Texts, 174 manuscripts were sent to the printer, and 158 publications were delivered by the printer. Work on these included 15,050 pages of manuscript edited and prepared for printing; 1,949 galley proofs and 7,064 page proofs revised and returned; indexes prepared for 41 publications, covering 2,075 pages and consisting of 6,279 entries. Copy edited in preparation for mimeographing included 83 pages of miscellaneous material.

Reports delivered were as follows: Professional Papers, 142–I, 221–E, 221–F, 221–G, 221–H, 222, 223, and 229; Bulletins 955–D, 955–E, 955–F, 962–B, 962–D, 963–B, 963–C, 963–D, 964–D, 964–E, 965–B, 969–A, 969–B, 969–C, 969–D, 969–E, 973–A, 974–A, 974–B, 974–C, 976–B, 976–C, 976–D, 977, 978–A, and 981–A; Water-Supply Papers 1050, 1068, 1072, 1081, 1085, 1092, 1093, 1095, 1096, 1097, 1098, 1100, 1101, 1104, 1112, 1113, 1114, 1115, 1116, 1117, 1118, 1119, 1120, 1121, 1122, 1124, 1127, and 1149; Circulars 40, 67, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 90, 91, 92, 94, 95, 97, 98, 99, 100, 101, 102, 103, 104, 105, 108, 110, 111, 112, 113, 114, 115, 121, 123; chapters 2A1, 2D1, 2D2, 4D5, and 6A3 of Topographic Instructions; and miscellaneous reports. These reports cover a wide range of subject matter—general geology of particular areas, mining districts, and local mineral deposits in the United States, Alaska, Brazil, Hawaii, Mexico, and Palau Is-ands; studies of fossils and the rocks in which they are found; a ollection of papers on geochemical research; Geophysical Abstracts, quarterly serial; measurements of stream flow and of water levels and rtesian pressure in wells; general studies of underground water and f the occurrence of floods, with consideration of the influence of eology and physiography.

In order to keep the public informed, 12 lists of new publications vere issued. Also printed during the year were 29 State index cirulars; 34 pamphlets to accompany index circulars; and the second upplement to Publications of the Geological Survey, 1948. Copy or the third supplement was prepared.

llustrations

Of a total of 24 reports on hand at the beginning of the fiscal year, 21 were in various stages of completion. Fifty-nine reports were reeived and 45 were completed and transmitted, leaving a total of 38 eports on hand, 19 of which were in various stages of completion. Those transmitted included 14 professional papers, 22 bulletins, and 9 water-supply papers, which contained 1,074 completed drawings nd photographs. Illustrations were prepared for 16 circulars. In ddition, a large number of miscellaneous pieces of drafting were ompleted.

Map Reproduction

During the year 6 newly engraved topographic maps, 763 multiolor topographic maps, 17 river survey maps, 6 planimetric maps, 9 geologic index maps, 37 topographic index maps, 127 geologic preliminary maps, and 37 special maps were printed, making a total of 1,002 new maps printed and delivered. Reprint editions of 290 engraved topographic maps, 33 multicolor maps, and 67 photolithographed State, geologic, planimetric, preliminary, and other maps were printed and delivered. Of new and reprinted maps, 1,392 different editions, amounting to 3,307,417 copies, were delivered.

Work was done for 51 units of the Government, including branches of the Geological Survey, and for the States. Charges for this work amounted to $793,674.64, for which the Geological Survey appropriation was reimbursed.

Transfer impressions and velox and plate prints numbering 182 were made during the year.

Including topographic maps and contract and miscellaneous work of all kinds, a grand total of 3,594,529 copies were printed and delivered.

The photographic laboratory made 9,011 negatives, 9,626 prints, 5,717 photolith press plates, and 532 lantern slides; developed 84 film packs and 190 rolls of film; and developed and printed 49,300 feet of aerial film.

Distribution

There were received during the year a total of 1,446 publications, comprising 108 new book reports and pamphlets and 10 reprints; 17 oil- and gas-investigations maps and charts, 7 coal-investigations maps, 74 geophysical-investigations maps, and 14 other geologic maps (including 11 geologic quadrangle maps); 5 river surveys; 814 new or revised topographic and other maps and indexes (including 52 maps turned over to the Survey by the Army Map Service and 40 Tennessee Valley Authority maps with contours); and 370 reprinted maps.

The total units received numbered 165,294 books and pamphlets (including 16,517 reprints), 194,695 copies of revised index maps, and 3,265,505 topographic and other maps, a grand total of 3,642,011.

Units distributed included 117,955 books and pamphlets, 1,191 geologic folios, and 1,726,200 maps, a grand total of 1,845,346, of which 1,190 folios and 1,162,047 maps were sold. Distribution of maps and folios was divided among Survey offices as follows:

Washington	1,141,246
Denver	577,143
Other field offices	9,001
Total	1,727,390

The net proceeds from sales of maps and folios amounted to $168,594.61. The breakdown of money received is as follows:

Washington	$118,703.87
Denver	45,214.34
Other field offices	4,676.40
Total	$168,594.61

In addition, $14,900.68 was repaid by other Government agencies for maps or folios furnished. The total net receipts for maps and folios, therefore, amounted to $183,495.29, a decrease of $6,567.25. Local Washington "over-the-counter" sale of maps to 8,916 private individuals amounted to $6,123.72, a decrease of $283.26 below last year. A total of 71,181 letters were handled.

The following table shows the publications on hand July 1, 1950, those received and distributed during the year, and the totals on hand June 30, 1951.

	On hand June 30, 1951	Received	Distributed	On hand June 30, 1951
ologic folios	13, 222		1, 191	12, 031
ıps	20, 056, 677	3, 265, 505	1, 726, 200	21, 595, 982
oks and pamphlets:				
Complete volumes	136, 196	55, 963	40, 217	151, 942
Separate chapters, extracts, and miscellaneous pamphlets	209, 426	118, 464	77, 738	250, 152
Total	20, 415, 521	3, 439, 943	1, 845, 346	22, 010, 107

UNDS

During the fiscal year 1951 obligations were incurred under the ırection of the Geological Survey totaling $36,373,066. Of this mount 51 percent was appropriated directly to the Geological Surey, 37 percent was made available by other Federal agencies, and 2 percent was contributed by States and their political subdivisions.

bligations incurred by the Geological Survey in fiscal year 1951 (by source of funds)

opographic surveys and mapping:	
Geological Survey appropriation	$7, 521, 327
States, counties, and municipalities	1, 248, 287
Department of the Interior:	
Bureau of Reclamation	2, 812, 249
Department of Commerce:	
Bureau of Public Roads	49, 965
Department of Defense:	
Department of the Air Force	623, 978
Department of the Army	618, 069
Department of the Navy	28, 631
Miscellaneous Federal agencies	256, 593
Sale to the public of aerial photographs and photographic copies of records	27, 260
Total	$13, 186, 359
eologic and mineral-resource surveys and mapping:	
Geological Survey appropriation	$4, 073, 520
States, counties, and municipalities	205, 110
Department of the Interior:	
Bureau of Indian Affairs	8, 079
Bureau of Mines	16, 417
Bureau of Reclamation	454, 943
Defense Minerals Administration	279, 136
Petroleum Administration for Defense	54, 500
Department of Defense:	
Department of the Air Force	12, 787
Department of the Army	642, 814
Department of the Navy	338, 249

Obligations incurred by the Geological Survey in fiscal year 1951 (by source of funds)—Continued

Geologic and mineral-resource surveys and mapping—Continued	
Department of State	$476,726
Atomic Energy Commission	2,946,323
Economic Cooperation Administration	160,782
Miscellaneous Federal agencies	28,139
Total	$9,697,525
Water-resources investigations:	
Geological Survey appropriation	$5,155,734
States, counties, and municipalities	3,065,497
Department of the Interior:	
Bonneville Power Administration	17,362
Bureau of Indian Affairs	106,346
Bureau of Reclamation	1,469,284
Department of Defense:	
Department of the Air Force	12,900
Department of the Army	885,140
Department of the Navy	47,714
Department of State	107,887
Atomic Energy Commission	192,344
Economic Cooperation Administration	2,666
Tennessee Valley Authority	83,388
Miscellaneous Federal agencies	305,006
Permittees and licensees of the Federal Power Commission	51,500
Total	$11,502,768
Soil and moisture conservation:	
Geological Survey appropriation	40,518
Classification of lands:	
Geological Survey appropriation	$322,791
Department of the Interior:	
Bureau of Reclamation	5,886
Miscellaneous Federal agencies	593
Total	$329,270
Supervision of mining and oil and gas leases:	
Geological Survey appropriation	$838,696
Department of the Interior:	
Petroleum Administration for Defense	2,788
Department of Defense:	
Department of the Navy	29,013
Miscellaneous Federal agencies	588
Total	$871,085

***ligations incurred by the Geological Survey in fiscal year 1951 (by source of funds)*—Continued**

neral administration:	
Geological Survey appropriation	$476, 480
Department of the Interior:	
Bureau of Indian Affairs	3, 314
Bureau of Reclamation	128, 519
Defense Minerals Administration	1, 800
Department of Defense:	
Department of the Air Force	9, 800
Department of the Army	61, 457
Department of the Navy	7, 679
Department of State	300
Atomic Energy Commission	50, 192
Economic Cooperation Administration	6, 000
Total	$745, 541
mmary:	
Geological Survey appropriation	$18, 429, 066
States, counties, and municipalities	4, 518, 894
Other Federal agencies	13, 346, 346
Permittees and licensees of the Federal Power Commission	51, 500
Sale to the public of aerial photographs and photographic copies of records	27, 260
Grand total	$36, 373, 066

Oil and Gas Division

Hugh A. Stewart, Acting Director

ON MAY 6, 1951, the Oil and Gas Division bega its sixth year of coordinating and unifying oil and gas policy an administrative activities of the several departments and agencies an serving as the channel of communication with the petroleum industry. During the first 5 years of its existence, OGD had also kep informed with respect to the adequacy and availability of supplie of petroleum and its products to meet current and future needs o the Nation. Therefore, early in the fiscal year when there was grav threat to the peace of the world which required that the United State give military assistance to South Korea following aggression by Nort Korea, OGD having continuously studied the petroleum supply an demand situation was already proceeding with plans to assure promp and effective petroleum mobilization in event of a national emergenc

Immediate attention and consideration were given to the problem which confronted the petroleum industry and the Federal Government because of the increased demands for high octane aviation gasoline required by the military services. The Military Petroleu Advisory Board was asked on July 26 to make an investigation o the current and potential production of high octane aviation gasolin by the refining industry. The Division participated in the work an determined the action necessary to assure an adequate supply of aviation gasoline and its components. The Armed Services Petroleu Purchasing Agency called upon the Division for assistance in connection with difficulties being experienced in obtaining sufficien aviation gasoline to meet their requirements. Because of the problems encountered in obtaining additional emergency supplies, i response to a request by letter of July 21, 1950, of the Secretary o the Interior, the National Petroleum Council reactivated its Committee on Military and Government Petroleum Requirements to assis the Federal Government in meeting its needs for various petroleu products. In August, the Secretary of the Interior made a publi appeal to the petroleum industry calling for increased production o aromatic blending components of aviation gasoline and urging th industry to eliminate the use of aviation alkylate in motor gasoline and to blend this component into aviation gasoline, and requested that alkylate plants be operated at full capacity. Then, on September 1, 1950, the Secretary of the Interior sent telegrams to the 35 principal refiners of aviation gasoline calling attention to the critical aviation gasoline supply for the military services, the necessity for supplying 30 percent more avgas than previously estimated and suggested seven principles to be followed by refiners in their operations. As the fiscal year ended, all demands of both the military and civilian economy were being met.

The Division advised and assisted the Department of State on foreign petroleum policy matters and actively participated in the work of the Interdepartmental Committee dealing with international petroleum policy matters.

The Division made a study of the oil import policy and its relation to the over-all petroleum and fuel policy. It was concluded that no action by the Federal Government should be taken currently to restrict imports of petroleum.

The entire Department's concern and interest in matters affecting export policy and export control were maintained by the Division through representation on Department of Commerce committees and its various task groups and by the close working relationships which the Division established with agencies within the Department.

The Division also served as a member of an Interdepartmental Rubber Committee, under the chairmanship of the National Security Resources Board. The Division advised the Rubber Reserve Corporation that butylene from petroleum was in tight supply and provided information on and assistance in securing additional sources of supply.

The Division assisted the Water Resources Policy Commission and represented the Department on its Committee on Domestic Water Navigation Projects and National Transportation Policy.

The Division continued to represent the Department at the quarterly meetings of the Interstate Oil Compact Commission, and maintained liaison directly with the State regulatory authorities and also through the Federal Petroleum Board, under the supervision of the Oil and Gas Division.

About mid-June the National Petroleum Council had given 5 years' service providing the Federal Government with advice and information. Since its etablishment, NPC had complied with 56 requests for information and data on which 106 reports were made. Eight requests were rejected by NPC.

In gearing its activities to the Nation's preparedness program for security and defense, the Oil and Gas Division and the Department of Defense not only called upon but relied greatly on the Military Petroleum Advisory Board for advice and information on matters classified in nature. More than 200 industry representatives served on the Board's panels and committees in the preparation of material for use of the Board in giving advice and service to the Federal Government.

The following transfer of certain Oil and Gas Division functions was made on December 1, 1950 (Order No. 2602), by the Secretary of the Interior: Except with respect to the performance of functions relating to the administration and enforcement of the act of February 22, 1935, as amended (15 U. S. C., 1946 ed., secs. 715–715k) and except with respect to the performance of functions relating to the operations of the Bureau of Mines, the Geological Survey, and the functions of the Bureau of Land Management and Bureau of Indian Affairs respecting the leasing of mineral lands, the functions of the Oil and Gas Division, provided for in order No. 2193, shall be performed by the Petroleum Administration for Defense. The personnel, files, records, papers, and equipment of the Oil and Gas Division, except those required in the administration of the act of February 22, 1935, and in the administration of the additional functions referred to above, are transferred to the Petroleum Administration for Defense.

Conservation of oil and associated mineral resources of the Nation is of far greater concern today than it was when the Connally "Hot Oil" Act was enacted by Congress in 1935, as a necessary complement of the oil conservation laws of the several States. The act is adminitered by the Federal Petroleum Board, under the direction of the Secretary of the Interior and the supervision of the Oil and Gas Division of the Department of the Interior. Its principal purpose and effect is to prohibit the shipment or transportation in interstate and foreign commerce of all oil and oil products produced in excess of amounts permitted to be produced under State law and regulations prescribed thereunder.

The Board, with a personnel of less than 30 people, consisting of a chairman, member, alternate member, and some 13 to 14 field examiners, together with a clerical staff, carries on its functions through a headquarters office at Kilgore, Tex., and suboffices located at Midland and Houston, Tex., and Lafayette, La.

While the act is applicable wherever State laws limit the rate of production and prescribe conditions for producing and handling oil, its chief application occurs in the States of Texas, Louisiana, and New Mexico, where regulations prescribed under the act are actively enforced by the Board and its staff. Enforcement activities are also carried on in the States of Mississippi, Oklahoma, Arkansas, Kansas, and other oil-producing States.

In administering the act, the primary aim is to secure the widest possible adherence to its provisions, and to this end sanctions are judicially applied whenever violations of a substantial nature are discovered. This purpose is achieved primarily through continuous field investigations carried on by the examining staff, observing and inspecting, producing, transporting, storing, and processing operations, and by the inspection and auditing of prescribed records and reports, aided whenever necessary through the conduct of investigative hearings.

In order that the burden upon the oil industry may be kept at a minimum, the regulations prescribed under the act limit the requirements for the keeping of daily operating records and the filing of monthly reports to those areas where, because of relatively high differential between potential and allowable production, and the presence of other factors tending to result in circumventions of the act, violations are deemed most likely to occur. This area, known as the designated area, is defined in the regulations and, while subject to change, presently consists of 106 counties in the State of Texas, the counties of Lea and Eddy in the State of New Mexico, and all of the State of Louisiana.

From the designated area, the Board receives and processes each month approximately 5,700 monthly reports, some 5,000 of which are filed by producers, about 550 by transporters and storers, and the remainder by processors and refiners. These reports cover operations in over 1,000 separate oil fields, and account for crude oil produced from more than 62,000 wells, with a total average monthly production in excess of 68 million barrels of crude oil, or about 39 percent of the entire production of crude oil in the United States.

At the beginning of the fiscal year, 17 separate cases were pending on the dockets of the Board, 4 of which were awaiting disposition in the Federal District Courts in Texas and Louisiana, 5 were undergoing further investigation by the Board, 2 were pending review and administrative disposition by the Board, 1 was pending review by the Solicitor of the Department of the Interior, and 5 were pending initiation of prosecution by the Department of Justice. During the year investigations were formally initiated in 12 new cases, making a total of 29 cases receiving consideration during the fiscal year.

During the year 12 cases were fully closed and 1 other closed only as to some phases of the violations, 1 by acquittal, 1 by dismissal, 1 by grand jury no bill, 2 by administrative action, and the remainder by successful prosecution, resulting in the imposition and collection of an aggregate of $33,000 in fines and one 2-year prison sentence. This compares with 14 cases disposed of the previous year, 10 by successful prosecution, resulting in imposition and collection of $52,950 in fines.

At the close of the year 17 cases were pending, 5 in an investigative status, 3 pending review by the Board, 2 awaiting administrative disposition, that is, 1 by the Oil and Gas Division, and 1 by the Department of Justice, 5 pending disposition by United States Attorneys, and 2 pending in the United States District Courts.

The traditional policy of full cooperation with other public authorities dealing with the same subject matter continued to characterize the activities of the Board, and resulted in suits for penalties being filed by local authorities in the States of Mississippi and Texas, with a fine of $25,000 imposed in one case concluded in Texas.

Thus while instances of violations of the Connally Act are still quite numerous in the aggregate, the general adherence to its provisions fostered by the constant vigil of the Board is very satisfactory.

Division of Land Utilization

Lee Muck, Director

WITH THE ISSUANCE by the Secretary on December 1, 1950, of order No. 2600, the Office of Land Utilization was reorganized and established as the Division of Land Utilization to provide "technical staff assistance for the Assistant Secretary for Public Land Management on land use and community service management and in the development and coordination of programs in these areas." This, therefore, constitutes a final report of progress achieved by the Office of Land Utilization, as well as a statement of the proposed program of service which the new Division of Land Utilization intends to provide for the Assistant Secretary for Public Land Management.

During the nearly 11 years in which the Office of Land Utilization acted as the pioneer staff agency of the Department in the field of land management, three generally successful methods of coordination, founded on cooperation, were evolved, namely: programing, which included the approval of bureau project plans and the preparation and justification of integrated budgets and fiscal control; the review of action documents for the Secretary leading to further Bureau work or final action by the Secretary; and the dissemination of timely authoritative information through documents, conferences, or field inspections to induce as complete as possible discussion of problems leading to closer cooperation and coordination among the land managing agencies. Little change is contemplated under item 2 and 3 above, except to expand the field of responsibility from one of land management alone to include the broader field of community service management. It is with respect to operational programing that a major shift in emphasis has been effected.

Specific fields of programing, as supervised by the Office of Land Utilization during its history, included the Soil and Moisture Conservation program instituted in 1940; the White Pine Blister Rust Control program instituted in 1942; the Emergency Fire Control program instituted in 1942, terminated in 1945, and now in process of reactivation as the Wildland Fire Planning program; the Civilian

Public Service program transferred to the Office of Land Utilizatio in 1943 and terminated in 1947; and the Forest Pest Control progra instituted in 1948. These programs had a common foundatio namely; similar needs for identical project activities on comparab public lands, which provided the basis for coordinated programin at the Department level.

Since 1945, a shift in administrative philosophy within the Department has tended to emphasize the delegation of operating authority and the coordination of bureau activities through the mediur of long-range planning and more tightly drawn and detailed policie Specifically, this shift in emphasis has tended to eliminate the preparation and justification of integrated budgets and fiscal control a the Department level. In the case of the Soil and Moisture Conservation program, these functions have been transferred to the operating bureaus. In the case of the White Pine Blister Rust Contro and Forest Pest Control programs, fiscal control was shifted to th Division of Administrative Services. If the Wildland Fire Planning project is implemented with funds, it appears that it will b supervised by the Division of Land Utilization in a manner quit similar to that followed during World War II.

ACCOMPLISHMENTS IN COORDINATION

The specific accomplishments heretofore made in the formulatior and application of a complete and coordinated program for the Department in the field of land and resource management follows.

1. The planning of a systematic and orderly program looking toward the conservation of the soil resources on all the lands under the jurisdiction of the Department.

2. The development of a more effective forest and range protection program and the coordination of forest management activities.

3. The establishment of sound land classification activities and the clarification of land policies.

4. The harmonizing and adjusting of the respective resource management programs.

5. The development of closer cooperation in dealing with other interests and other departments and agencies in the conservation field.

SOIL AND MOISTURE CONSERVATION PROGRAM

For generations prior to 1940 large segments of the public and Indian lands had been deteriorating through neglect and improper management. At that time, it was estimated that 133,000,000 acres of the 282,000,000 acres under the jurisdiction of the Department were seriously impaired by erosion and in need of soil and moisture conservation treatment.

The past decade was one of the most critical periods in United States agricultural history. The American farmer responded to, and met, the greatest demand for agricultural production ever before required of him. In this same period, the Soil and Moisture Conservation program has been a tremendous force in attaining increased yields on crop and grazing lands. Concurrently, efficient management of natural resources has been stressed and strengthened to the point where it dominates the Department's activities on public and Indian lands.

It is estimated that some soil conservation practices have been initiated on about 30,000,000 acres of public and Indian lands. The productive capacity of the Federal range lands was considered to be not more than 50 percent effective. On those areas where seeding, water control and utilization, rodent and weed control, and other soil conservation practices have been instituted, the productive capacity is believed to be increased at least 15 percent. On Indian crop lands, where complete soil and moisture conservation practices are being applied, crop yields have increased an average of 35 percent.

The productive capacity and effective use of over 25,000,000 acres of public and Indian lands are very seriously curtailed by weeds and brush. Recent surveys disclose 4,400,000 acres infested with noxious and poisonous weeds; 220,000 acres with plants consuming excessive amounts of water in arid regions; and over 21,000,000 acres of brush. National needs dictate that some definite and effective means be provided to make these lands more useful.

WHITE PINE BLISTER RUST CONTROL PROGRAM

There are within the lands administered by the Department approximately 600,000 acres of valuable white pine stands which require protection from the white pine blister rust—a fungus disease of foreign origin. This disease is fatal to white pines, including three of the most valuable timber trees in the United States, namely, the eastern white pine, the western white pine, and the sugar pine. The purpose of the white pine blister rust control operations is to protect these valuable pines by the eradication of Ribes (currant and gooseberry bushes), the alternate host of the disease.

Progress of the control work on lands under the supervision of the National Park Service, the Bureau of Indian Affairs, and the Bureau of Land Mangement since 1942 has been very satisfactory. As of December 31, 1950, 478,959 acres had received initial eradication, or 79 percent of the total acreage requiring protection.

FOREST PEST CONTROL PROGRAM

This program authorized by the act of June 25, 1947, provide for a national drive against all serious epidemics of forest insects an diseases attacking the valuable forests of the Nation—Federal, State and private. After being placed on a fully coordinated basis withi the Department in 1947, it has provided for control work agains many minor attacks, as well as several major infestations, namely mountain pine beetle infestation on lodgepole pine in western Wyoming, spruce budworm infestation on Douglas fir in Oregon, mistleto in Arizona, and western pine beetle in California. Ordinarily, th damage caused by these pests is less conspicuous than is fire damage but the task of providing for the prompt detection and evaluation o the control problem is much more difficult than with respect to fire The degree of protection afforded our forests from insects and disease will determine how successful our management may ultimately be

WATER RESOURCES COORDINATION

In accordance with order No. 2574 of July 17, 1950, which provide specific supervisory functions for the assistant secretaries, the staf of the Water Resources Subcommittee, formerly attached to the Offic of Land Utilization, was transferred to the Office of the Assistan Secretary for Water and Power.

LOOKING FORWARD

The technical staff assistance which order No. 2600 requires to b provided by the Division of Land Utilization to the Assistant Secretary for Public Land Management will be furnished through routin day-to-day operations, regular planning of operational programs, an long-range program planning.

The routine day-to-day operations of the Division will consist o the review of action documents, including appeals and periodic reports; day-to-day dealings with bureaus, including field inspections tending toward the improvement of bureau performance; collaboration with the bureaus in the formulation, revision, and expeditio of regulations and legislation; and the performance of special tasks including service on inter and intradepartmental committees an boards.

Allied to the day-to-day routine are the regular operational planning activities of the Division, including staff supervision over soi and moisture, white pine blister rust, and forest pest control operations, and the review of river basin development programs of agencie of the Department. These day-to-day tasks mesh into the long-rang planning program which seeks to secure for each resource field the nature, use, and importance of the resource; its production and depletion; proportion of resource under Department of Interior responsibility; the objectives to be sought in its conservation, development and use; the adequacy of present programs to achieve the objectives sought; and the relationship of one resource to another.

The ultimate objective is to assist the Assistant Secretary for Public Land Management to achieve complete coordination and integration of the land management functions and activities of the Department of the Interior in accordance with a master plan designed to reach all categories of public lands with the over-all view of administering and developing the natural resources under the management of the Department at the highest possible level of efficiency and economy.

Bureau of Land Management

Marion Clawson, Director

REALIZING THAT THE LAND and the protection and development of the land and its resources are a Nation's primary line of defense, the Bureau of Land Management during the past year has geared its activities to a program that will serve not only present emergency needs but will protect and develop natural resources on the public lands for continuing strength and solidarity of the West and the whole country.

Reports from the seven regional offices of this agency, which has jurisdiction over 500 million acres of public lands in the United States and Alaska, reveal the importance of these federally administered acres to national security and prosperity.

Operating on the belief that a Federal program, like a large business enterprise, should show a net gain, the Bureau of Land Management balanced its books at the end of fiscal year 1951 and is able to show the following figures: $8,786,543 in appropriations for management of land and resources contrasted with an estimated $49,082,331 in receipts payable to State and Federal treasuries.

The record thus reveals approximately $6 for every dollar of appropriation. This does not account for returns in the form of homes for veterans, and more minerals and timber and forage supplies for defense.

Although each activity of the Bureau of Land Management is an integral part of the whole program, the six basic divisional activities are as follows: cadastral engineering, land classification and planning, adjudication, range management, forestry, and administration. This report not only provides a brief account of each of these operations, but it also includes a discussion of some of the legal responsibilities of the Bureau, which was formed in 1946 by consolidation of the General Land Office and the Grazing Service.

Looking at this year's record against an historical background of 139 years' service to the people, it is encouraging to note that the public lands from which 29 States and a Territory have been carved and from which millions of privately owned homesteads have been provided to veterans and others, still offers present and potential resources of inestimable value to the Nation. These resources, many of them renewable if properly administered, are in the form of timber, oil, forage, coal, uranium, and other strategic materials in demand for defense and necessary for stabilization of western as well as national economy.

The activities of the Bureau of Land Management during recent years have shown, as indicated in the six-to-one return on each dollar appropriated, the monetary worth of wise management of these resources. Related benefits in the form of homes and small businesses have not and cannot be weighed on counting-house scales, but these benefits are national assets that figure high in preservation of the democratic concept in this and other countries. People of other nations, looking to their own lands for recuperative powers, are calling on Bureau of Land Management specialists for assistance in solving land problems such as tenure of title, surveying, and maintenance of land records.

The Bureau of Land Management, even while providing technical knowledge wherever possible and where funds are provided under the President's point 4 program, is, of course, giving priority to its manifold home activities.

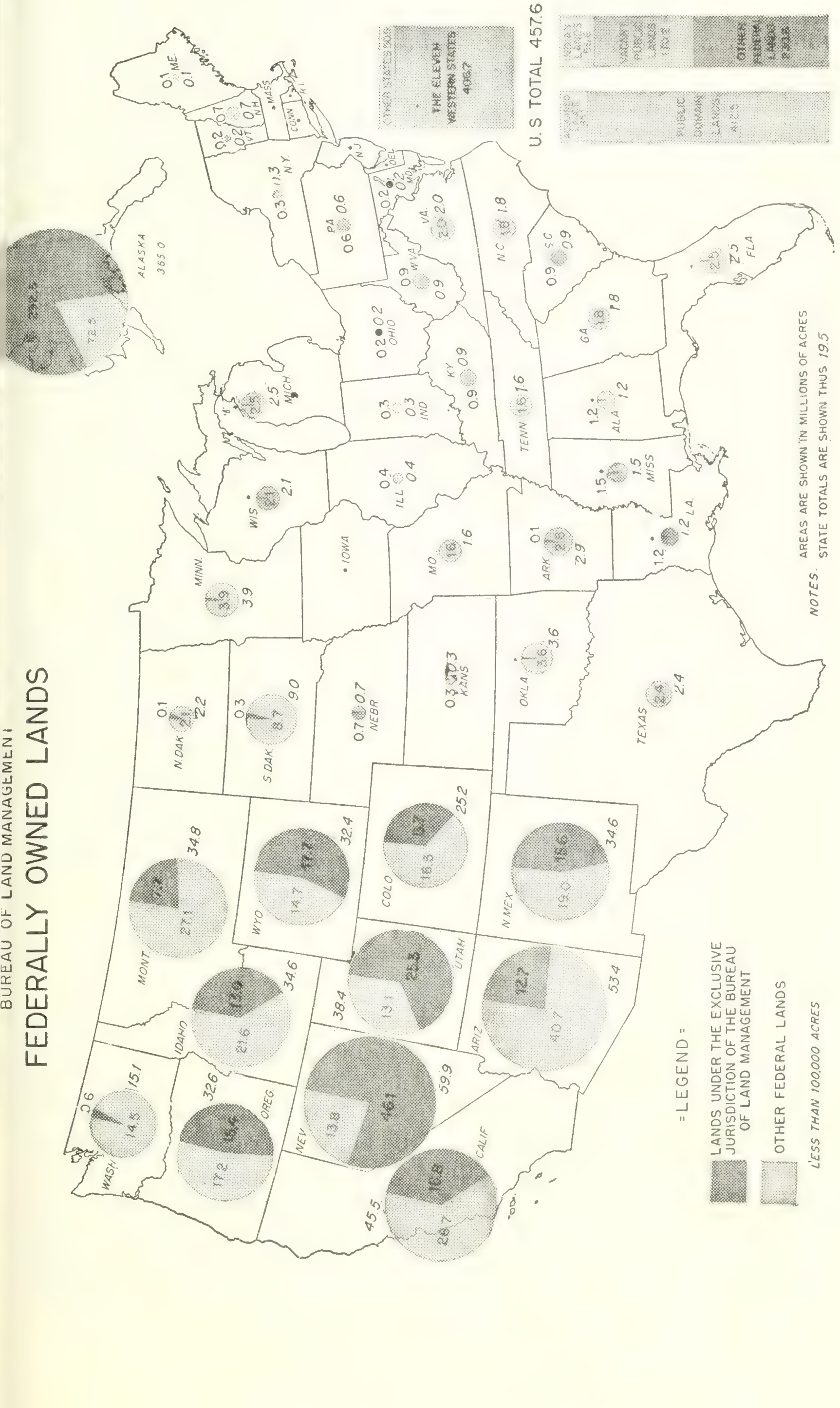
With the closing of this year's books, the Bureau of Land Management continues to move efficiently forward on a program which will protect the land interests of present and future generations of Americans and to guarantee continuing natural resources from the public-domain lands under its jurisdiction.

CADASTRAL SURVEYING ACTIVITIES

Basic to the work of all Bureau of Land Management operations and that of other Federal agencies, the States and the general public are cadastral surveys that create, reestablish and identify land boundaries and subdivide areas into usable economic units. The intermingling of privately owned lands with the public lands has made this function one of outstanding importance. The cadastral surveying program carried on during the year has been geared to meet the need for resource development created by the national emergency.

Surveys in the Continental United States

Completion of the original surveys in Continental United States is one of the major projects remaining for the Bureau of Land Management. The value and need for timber, the potential value of mineral deposits and the necessity for making surveys to satisfy school



BUREAU OF LAND MANAGEMENT

FEDERALLY OWNED LANDS

= LEGEND =

▨ LANDS UNDER THE EXCLUSIVE JURISDICTION OF THE BUREAU OF LAND MANAGEMENT

░ OTHER FEDERAL LANDS

• LESS THAN 100,000 ACRES

NOTES: AREAS ARE SHOWN IN MILLIONS OF ACRES
STATE TOTALS ARE SHOWN THUS *19.5*

grants to the States as provided by law, constitute the primary need for this work. Approximately 100 million acres of public lands remain to be surveyed in the United States. In addition, due to the obliteration of the monuments established in the original surveys, there is an actual demand for the resurvey of over 50 million acres located in the Western States. Title to about 50 percent of the area of the 11 Western States is still in the Government and the resurveys are necessary for proper resource development and management.

Only the most urgent projects, basic for the development and management of resources have been possible with available funds. Projects of this character initiated and carried on during the fiscal year included the cadastral survey of lands for the Atomic Energy Commission in connection with the development of uranium deposits; identification of lands leased for oil and gas; survey of areas in the Missouri River Basin and the Big Thompson project for the Bureau of Reclamation; surveys needed for the administration of the public lands in connection with range and forest management activities; for lands classified for administration under the Small Tract Act; for O & C lands; and other areas not previously surveyed for administrative purposes and to identify the school sections in order that title may pass to the States.

In addition to these projects, surveys or resurveys were made for the Bureau of Indian Affairs on the Navajo Indian Reservation, Ariz. and N. Mex., and along the Red and Arkansas Rivers in Oklahoma needed for the exploration of minerals; areas in Nevada to afford descriptions for stock-watering holes and to identify land for the construction of water reservoirs; boundaries of the Dugway Proving Ground in Utah for the Department of the Army; an airport in northern California for Civil Aeronautics; and islands, omitted lands, and accretion areas in North Dakota, Alabama, Florida, Louisiana, Michigan, Minnesota, and Wisconsin.

Surveys in Alaska

The cadastral engineering program should be accelerated materially in Alaska. Lack of surveys is seriously retarding the settlement and the development of resources in that Territory. The identification of land areas by cadastral surveys is necessary for the acquisition or use of the land, homesteading, the establishment of townsites, the adjudication of applications, providing areas for homes under the Small Tract Act, and the administration of many of the public land laws. High priority has been given to surveys in the vicinity of Anchorage to provide small tracts for those engaged in the military development.

During the fiscal year the most urgent Alaskan projects consisted of the survey of 15,620 acres and the resurvey of 15,280 acres located in the vicinity of Anchorage and Haines, for settlement purposes. This area was further subdivided into 1,072 5-acre tracts and 528 2½-acre tracts. Sixty miles of the center line of highways were traversed; 612 townsite lots located in the Anchorage, Kenai, Ninilchik, and Aniak areas; 389 homesites in National Forests in southeastern Alaska; and 34 individual tracts scattered through the Territory were surveyed.

LAND CLASSIFICATION AND PLANNING

In the domestic field, land classification objectives of the Bureau of Land Management are to determine the highest and best uses of the Bureau's lands and the land-tenure arrangements that will promote such uses. Its planning efforts are devoted to the development of a well-integrated program wherein all tenure, protection, rehabilitation, development, and use activities are properly and effectively balanced and implemented. In the international field, the Bureau is seeking to make available to the underdeveloped nations of the world the know-how of modern public-land management and the principles of resource utilization.

Land-Use and Tenure Activities

During the year, the Bureau took significant steps to maximize the effectiveness of its available facilities. Primary responsibility for the examination of the Bureau's lands and for the initial determination of their highest and best use was decentralized to the area managers. In addition, the Bureau during the year developed further its policy of making small-area studies and classifications. The small-area technique was used throughout the West and included studies of Fish Lake Valley (Calif. and Nev.), Raft River area (Idaho), Inyokern Naval Station area (California), Dove Creek (Utah), and several basins in Arizona. Many other studies have been projected, such as Rogue River Basin (Oreg.), Hells Canyon Dam area (Idaho), and the Lower Colorado area (Arizona, California, Nevada, Utah), but sufficient staff is not yet on hand to undertake them. The studies which have been completed have helped to solve difficult land-use problems. However, the urgency of demands on the Bureau forced the staff during the year to concentrate largely on examination of individual tracts.

Experience with the Missouri River Basin investigations continues to show the great advantages of full-scale basin studies. Without such studies, the classification operations of the Bureau are largely controlled by the nature and location of applications for resources. Considerable attention has to be devoted to problem areas which suddenly become critical in various parts of the West, calling for disproportionate exenditures of time and effort. In the Missouri Basin region, the basin studies have enabled the BLM to undertake a directed positive program of land-use adjustment and of other land-use programs also. Among the beneficiaries of the Bureau's adjustment activities in that Basin are the Theodore Roosevelt National Memorial Park, Custer State Park, Casper Alcova irrigation project, the Nebraska and other national forests, various State wildlife projects, and many private individuals. During the year the Bureau classified 1.8 million acres of public lands in the Missouri River Basin. Classification of these public lands involved also the study of intermingled nonpublic lands totaling more than 1¾ million acres. Towards the end of the year, the Bureau initiated field studies in connection with the comprehensive program for the Arkansas-White-Red River basins. These studies, when completed, will permit the Bureau of Land Management to inaugurate a positive program for its holdings in those basins.

In Alaska, classification activities of the Bureau were concentrated largely upon supplying lands to satisfy the manifold demands engendered by the defense program. Large areas were transferred to the military and naval authorities for defense installations. Before completing such transfers, every effort is made by the Bureau to reduce the conflicts between military and civilian needs through negotiations with military personnel and other interested parties. During the year a large number of sites were also made available for individual residences, airports, housing projects, businesses, industries, and recreation. Homesteaders and others were given assistance to facilitate their settlement on the land. Shore space reserves, forest eliminations and other withdrawals were studied to make additional lands available for use and development. Potential grazing areas were examined and opened to lease. Presettlement studies were completed for the Kenai-Kasilof settlement area and forwarded to the Interagency Committee on Group Settlement in Alaska.

Other developments during the year included some progress in the Bureau's plans for a review of existing withdrawals and reservations. With financial help from four Interior agencies (Alaska Railroad, Alaska Roads Commission, Bureau of Indian Affairs, and the Fish and Wildlife Service), the Bureau of Land Management undertook an inventory of all withdrawals and reservations in Alaska. At the end of the year the inventory was close to completion. Plans are being made to have the results studied looking to the opening to other uses of areas which no longer should be withdrawn. In the States, the Bureau is expediting the review of selected withdrawn areas on its own motion and in cooperation with other interested agencies.

Ever-widening interest in lands for recreation has increased the Bureau's cooperative activities with the various recreational agencies, Federal, State, and local.

Program Plans

An outstanding development in planning during the year was the report of the President's Water Resources Policy Commission. Of particular interest to the Bureau was the Commission's findings as to the basic unity of land and water resource programs. This principle has been a primary concept of the Bureau's program planning and has been a major influence in BLM's active participation in interagency program committees. With jurisdiction over 25 percent of the land area of the Far West, the Bureau has an important responsibility to develop internally consistent programs integrated with those of other land and water interests in the West.

The Bureau's program plans are initiated at the area level, under the guidance of the regional and Washington offices which provide internal coordination. Interagency coordination is developed through the various interagency groups and through bilateral and multilateral direct contacts. Under these procedures a large body of area working plans have been constructed and a measure of interagency coordination has been achieved. Far more, however, has yet to be done.

Interagency committees have been making ever-increasing demands on the time of the small planning staff of the Bureau. The Bureau has submitted to various committees, such as the Columbia Basin Interagency Committee, the Alaska Field Committee, and the Colorado-Great Basin Field Committee, its 6-year programs in their areas of interest. Since land-management activities are generally far less advanced than water-development activities, these reports serve to point up the weak spots in the Government's resource-development programs, as well as their current status. In addition to these Committee reportings, BLM is called upon for special reports from time to time on land-management problems. All this activity has emphasized the need for a comprehensive Federal resource program based on adequate basic data and effectively coordinated throughout all its parts.

International Activities

The world situation of rapidly growing interrelationships in economic interests and the resultant desires for the exchange of technically trained personnel has drawn heavily upon the resources of the Bureau. Bureau personnel have participated in international programs and conferences in Pakistan, New Zealand, Germany, and most Latin American countries. Requests are accumulating from numerous countries for assignments of technicians on extended bases up to 2 years. About 70 technicians are being processed for these foreign services. Concurrently with the above, plans are being formulated and programs are being established to train qualified persons from other countries in the United States for the periods up to 1 year, including training on the job, institutional training, and supervised individual study and research.

ADJUDICATION ACTIVITIES

An increasing efficiency and closer cooperation between the field offices and Washington on the day-to-day adjudication operations has led to a speedier and more effective processing of the ever greater numbers of applications for military and civilian activities.

Food From Federal Lands

Increased food production for defense and for the bolstering of America's expanded needs both here and abroad has been helped by the issuance of permits for clam digging and canning operations in the Katmai National Monument, Alaska, and the many sales of isolated tracts in continental United States facilitating their maximum production and usefulness as additions to food-producing farms. Exchanges under the Taylor Grazing Act have consolidated Federal patterns by aiding conservation and rounding out the land holdings of large cattle producers—adding to the Nation's supply of beef for food, hides for military and civilian equipment, medical supplies, and other allied products.

Airports and Other Special Uses

Coordination between this Bureau and the Civil Aeronautics Administration has augmented the establishment on the public domain of the many airports set up during the year in the United States and Alaska under the Federal Airport Act. A valuable contribution to the defense of Alaska and the North American continent from attacks over the rooftop of the world was the opening of airports in Alaska at Dillingham, Ninilchik, Kotzebue, and Fort Yukon during the summer of 1950.

Such airports have aided materially in solving some of Alaska's transportation problems. They have also helped to promote the growth of this area by creating closer contact between the outlying areas and the centers of population in Alaska and elsewhere.

Large tracts of lands for defense have been withdrawn for the use of the Army, Navy, and Air Force for training camps, bombing and target ranges, and other military installations both here and in Alaska.

Granting of right-of-way for highways and telephone and telegraph lines, and advance approval to begin their construction have substantially added to the communications network across the country. The growth of a better understanding between Bureau officials and State highway officials has paved the way for improved administration of the Federal Highway Act. This act has contributed to a greatly extended highway system throughout the United States.

Patenting of the school sections during this past year has aided in the field of education by making available to the States additional revenues for building schools and extending and improving their educational systems. These revenues have been derived from the leasing of the surface of the school sections for grazing and other purposes, and the leasing of subsurface minerals.

Expediting of Oil and Mineral Leases and Patents

The greater emphasis on the use of machinery in the civilian economy as well as the mechanization of the Armed Forces has caused an unprecedented growth in the demand for oil and gas. The intensified exploration for these resources has increased the interest in the oil and gas content of privately owned and public domain lands.

During the year patents on land claims in Mississippi and Louisiana were issued to perfect titles to privately owned lands, where the link in the chain of title from the Federal government to the first private owner was missing. This has given the oil companies the opportunity to extend their exploration for oil and gas in these areas. The unusual rush for oil and gas leases on the public domain has resulted in the issuance of more than 2,500 oil and gas leases covering over 1,500,000 acres in Nevada and Utah, 49 oil and gas leases for lands in Alaska, and thousands of leases in other areas.

On October 13, 1950, the suspension was removed on oil and gas leases for acquired lands subject to the act of August 7, 1947. The removal of this suspension will bring additional revenue, through rentals—to the Federal Government, the States and the counties in which the lands are located—and will promote further exploration and development of this resource. Already more than 200 acquired lands oil and gas leases have been issued since October 13.

The act of September 6, 1950, authorized the Secretary of Agriculture to sell to surface owners the mineral interest in certain lands acquired by the United States and later resold with all or part of the minerals reserved to the United States. Action on all pending oil- and gas-lease applications was suspended to protect the interest of the surface owners and the Government, and to provide an opportunity to classify the lands and to develop proper operating procedures for disposal of these mineral resources.

Competitive bidding on oil and gas leases under the Mineral Leasing Act of 1920 involved a number of producing fields in California, Colorado, and other States, embracing more than 3,500 acres, from which cash bonuses were received totaling over $107,600.

Since July 1, 1950, additional action has been taken in connection with the coal lands in Oklahoma purchased from the Choctaw and Chickasaw Nations of Indians, resulting in the leasing of approximately 7,600 acres. Other action relating to coal deposits was the revision of the coal regulations, bringing about a more expeditious processing of leases thereunder, and a better conservation of both surface and coal resources. Coal-prospecting permits have also been issued since July 1, 1950, embracing over 22,000 acres. Such an aid to the exploration for coal deposits helps to build America's stockpile of this natural resource.

Considerable activity in other leaseable minerals has made available over 118,700 acres of land from which income was derived of about $89,000 for leases and permits for phosphate, bentonite, sodium, and potassium.

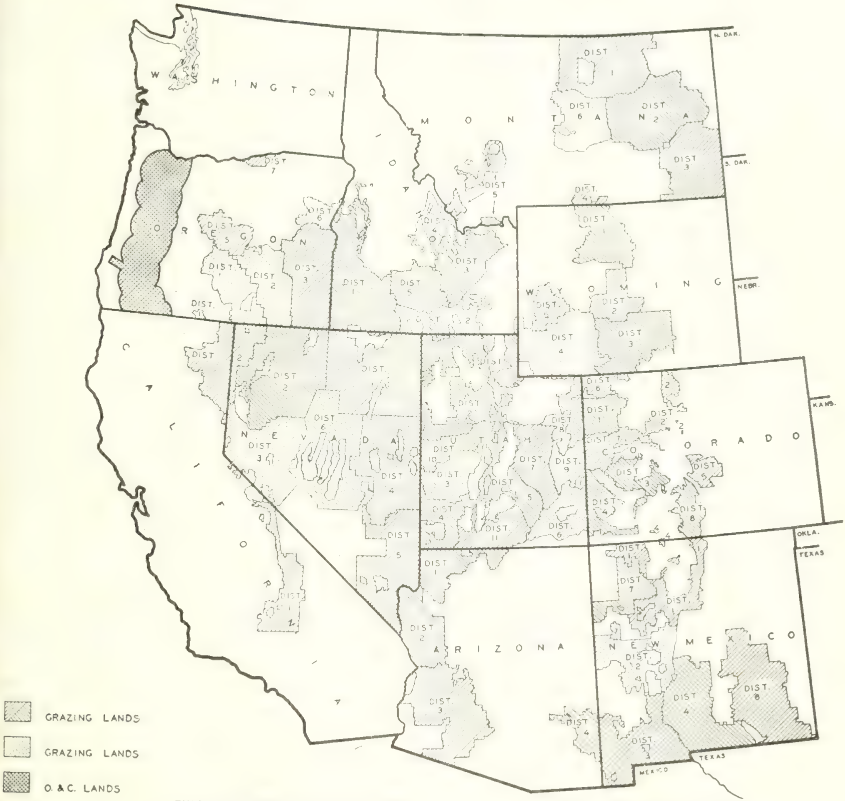
On December 11, 1950, the Supreme Court entered decrees favorable to the United States in the Gulf of Mexico submerged lands cases. Authorization was granted for the continuation of the operations being conducted in the Gulf of Mexico adjacent to the Texas and Louisiana coasts by the holders of State leases. This authorization also provided for the payment of rentals and royalties on the oil and gas extracted from the submerged lands, and other payments. These moneys are being deposited in a special account in the Treasury of the United States, pending further action as may hereafter be directed by Congress. The collections on these Louisiana and Texas submerged land operations, as well as those from the California submerged land area, amounted to more than $8,000,000.

Better "Across the Counter" Service

The frequent meetings and discussions between Washington and field personnel have produced a much better understanding of the problems involved in adjudication, and have created more consistency of action and speedier processing of applications for the defense requirements and the needs of the civilian population.

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

ORGANIZED MANAGEMENT AREAS



THIS MAP, OWING TO THEIR SCATTERED LOCATION, DOES NOT ATTEMPT TO SHOW APPROXIMATELY 13,000,000 ACRES OF SECTION 15 LEASES.

SECTION 15 LANDS ARE VACANT, UNAPPROPRIATED, UNRESERVED LANDS OUTSIDE OF GRAZING DISTRICTS WHICH ARE ALSO ADMINISTERED BY BLM UNDER THE TAYLOR GRAZING ACT.

IMPACT OF NATIONAL DEFENSE ON GRAZING RESOURCES

The importance of the public lands to the range livestock industry of the West is indicated by the fact that about 99 percent of the 186 million acres of public lands in continental United States, administered by the Bureau of Land Management, are situated in the 11 Western States. These lands supply approximately 16 million AUMs (or "animal unit months," which is feed for one cow, one horse, or five sheep for 1 month) of forage, annually, which amounts to one-third of the annual requirement of the range livestock, an essential link in such livestock operations.

The continuing of the range livestock industry on a sound and stable basis is contingent, therefore, on the wise management of the public lands and their resources with the view of bringing these ranges up to their maximum potential production. It is most essential also that other uses of the public lands, such as the harvesting of timber, minerals, and other resources, be carefully and fully integrated with the adminstration of grazing.

Range Conditions

Forage production on the ranges for fiscal 1951 varied from a crop of abundance in some areas to almost complete failure in others. Climatic factors on the ranges of Montana, Wyoming, Idaho, Oregon, northeast California and northern Nevada were very favorable, and forage conditions were generally above average in fall, winter, and late spring months. Most of these ranges were very dry during April, but May rains relieved this condition and resulted in a fine forage growth in May and June. Forage conditions in northern Nevada were particularly favorable as a result of a near record-high rainfall. Forage growth in northern Utah and northwest Colorado was about average. The winter throughout these northern regions was relatively mild and livestock came through in better than average conditions.

In sharp contrast to these favorable conditions was the critical drouth situation on the ranges of the Southwest. This was a continuation of similar adverse conditions which prevailed in 1950 in the south half of Nevada and California, southwest Colorado, and most of Arizona and New Mexico. Forage conditions on the Federal range were far below normal. In House Rock Valley, northern Arizona, for example, stockmen were forced to remove nearly all of their cattle from the range. Equally grave conditions confronted the stockmen in northwest New Mexico and other areas. Storms starting in early March and extending into late May were sufficient in some areas to start a good growth of grasses and weeds.

Grazing Administration

Shortage of manpower on grazing work continued as a serious handicap this fiscal year. The forces available, amounting to about 70 percent of the minimum staff proposed in the Nicholson report, were entirely inadequate to carry out the program to the desired degree and in an acceptable manner. This is reflected in the inadequacy of accomplishments in enforcement and supervision of range uses, range utilization studies, dependent property surveys, range inventories, the development of badly needed management plans, etc. Based on the nearly unanimous recommendation of the Advisory Boards the grazing fees were increased from 6 cents to 10 cents an AUM, effective May 1, 1951.

The organization meeting of ranchers who will apply for grazing privileges in the new district in Nevada was held at Tonopah on May 10. An advisory board of 12 members was elected to represent the livestock interests and advise the Bureau in the management of this district. Present plans call for the development of data on the Federal range and ranch properties which have been used in connection with it so that term permits can be issued to the majority of applicants when this district goes into active operation early in 1952.

The plan for a represenative of the Director's office to make an investigation of grazing administration in all districts in at least one region, annually, was continued with an inspection being made of grazing districts in Colorado and Utah. A proposal for the regional offices to conduct similar examinations in at least three districts, annually, also went into operation this year. In Region V, Arizona-New Mexico, inspections were made of 8 of the 10 grazing districts. The purpose of these inspections is to improve and unify administrative practices.

During 1951, authorizations were issued to 19,876 permittees and licensees, to graze 8,254,990 head of livestock on the public lands in grazing districts, including 2,218,638 cattle, 73,961 horses, 5,942,481 sheep, and 19,910 goats. Of the above authorizations, 10,277 of the operators are holders of 10-year grazing permits. This represents an increase of 124 term permits reported in 1950. This is brought about by the expiration of the permits issued in 1941. The issuance of new permits or the renewal of expired permits is contingent upon a close check of the supporting base properties, correlation of the grazing privileges with the carrying capacity of the Federal range, and equitable distribution between the qualified applicants.

As of June 30, 1951, 14,063,905 acres of the vacant public lands outside of grazing districts were covered in grazing leases issued to 11,268 stockmen. This represents an increase of acres leased during this fiscal year over the total area under lease at the beginning of the year. There are 14 million acres available for lease.

Cooperative Relationships

There is a growing evidence of benefits to the administration of public lands and the management of extensive acreages of interspersed private- and State-owned land through cooperative arrangements between the Bureau and other agencies, private and public. Of particular concern at this time is the expanding requirement for Federal rangeland for bombing and other military and defense activities. In the neighborhood of 11 million acres are now embraced in these military withdrawals and requests for additional areas continue. Some of the existing and pending withdrawals are in desert areas which have but slight grazing value at best, but others contain land of fairly high grazing capacity. By agreement, grazing uses of some of the latter are allowed to continue with minor adjustments, and there are others in which grazing must be excluded. The location and boundaries of these withdrawals and the continued use and management of them are matters for negotiation between representatives of the Bureau and military agencies.

Wildlife Management

The rapid recovery in wildlife numbers from the severe losses during the heavy winter of 1948–49 continued this year. These increases tended to aggravate the already knotty problems in the management of a number of winter game ranges, including concentrations in the Red Rock-Granite Peak area in Nevada, the Deer Flats area in Utah, and the Gunnison area in Colorado. There are a number of areas in Wyoming where the antelope herds are getting out of hand. Highly successful predator campaigns are responsible in large measure for the rapid increase in big game. Special hunts in one form or another designed to alleviate this problem are being set by the game departments of the various States. Also of assistance are the roads constructed into areas hitherto inaccessible to hunters, and reseeding of depleted ranges. There is a strong spirit of cooperation in all of these activities between the Bureau, State game departments, and sportsmen's organizations.

Soil and Moisture Conservation

The reports of the President's Water Resources Policy Commission have emphasized the importance of water conservation and control in the Western States where water is a limiting factor in economic development. The public lands under the jurisdiction of the Bureau of Land Management form important segments of the major river basins in this region. Recognizing its responsibility for proper use of these lands, the Bureau has directed its soil and moisture conservation operations toward a program of watershed treatment.

Although some progress has been made in developing and applying measures for the conservation and improvement of the public lands under the jurisdiction of the Bureau, when compared with the total job the program is little more than started.

Range Improvement

The emphasis on range improvements has been directed to those types of projects such as water developments and fencing, which facilitate proper distribution of livestock. Much of the responsibility for an active maintenance program has been assumed by the range users who keep in repair and operate many of the Government-owned improvements in accordance with cooperative maintenance agreements.

Halogeton Control

Halogeton glomeratus, an introduced poisonous plant, is rapidly spreading on western rangelands and is becoming a dangerous threat to the range livestock industry. It is estimated that approximately 640,000 acres of the public lands administered by the Bureau are infested with this weed. If funds are made available to the Bureau, a comprehensive program of control will be initiated in cooperation with other Federal and State agencies and with private individuals and corporations.

Range Revegetation

Range reseeding continued to play an important role in the rehabilitation of depleted rangelands, and those areas infested with undesirable plants. During the fiscal year, about 60,000 acres of depleted and invested rangelands were reseeded to hardy drought-resistant grasses, an increase of 30 percent over accomplishments in 1950.

ACCELERATED FORESTRY PROGRAM

A greatly accelerated demand for sawtimber and other forest products has developed, exceeding that of World War II and the postwar period.

Permanent lumber and other forest-using industries are wholly dependent in some localities and partially in others on the forest products harvested from these public lands.

Role of Forestry Staff

The functions of the forestry staff include: (1) Protection of forest and range resources against destruction by fire, insects, and disease; (2) marketing 500 million board feet of mature timber annually from the O & C Lands, and 100 million board feet annually from other public lands; and (3) the development of better timber stands for maximum productivity.

Operational problems include intensification of fire prevention and suppression, and disease and insect control; collection of basic data regarding mature timber and growing stocks of younger timber on the O & C lands and the public domain; preparation of management plans for timber and woodland areas within and outside grazing districts; marketing programs; wood-waste utilization studies; improvement of growing stock and reforesting of denuded lands; construction of access roads to reach inaccessible mature and overmature timber; and development of complementary resource values such as recreation, wildlife, soils, and watersheds.

Protection of Forest Resources

Successful management of this Bureau's natural resources is dependent upon its ability to protect these resources.

Fire control.—Development of a fire-control organization that can adequately protect 390 million acres of public domain requiring continued protection on a peacetime basis was given high priority. Obsolete communication and suppression equipment is being replaced with modern mechanized units, as rapidly as funds will permit. A radiotelephone employing very high-frequency-radio is used with satisfactory results in one district and plans for the use of VHF radio are under development in all the regions. High-pressure pumpers mounted on four-wheel drive trucks for fire suppression have been purchased in several grazing districts. These units have proven highly satisfactory in the reduction of areas burned and the number of fire fighters required on individual fires. The latter is of special importance during the present manpower shortage. In addition the Bureau has developed operational wildland fire-control plans for Civil Defense, as a part of the integrated Nation-wide planning of all agencies, Federal, State, county, and private.

This Bureau has the larger of the two fire organizations in Alaska and was therefore charged with the responsibility for coordinating all Civil Defense wildland fire plans for Alaska. Estimates and plans were entirely geared to meet the defense schedule and plans of the Alaska Command. These plans call for intensification in all operational phases of fire control—including personnel, equipment, supplies, and operating funds.

In the States of California, Idaho, Oregon, Montana, Washington, Arkansas, and Minnesota, 5,804,000 acres of timberlands located in areas too far from our grazing district fire control units to permit economical fire control by the Bureau directly are protected under contract by the States, State protective associations and the Forest Service. This area includes 2,148,000 acres of O & C lands in Western Oregon, bearing high value stands of Douglas-fir timber.

Disease control.—The control of forest tree diseases, which is at all times essential to sound forest management and the production of high quality timber, is even more critical under the burden of the national emergency.

White pine blister rust, a disease common to the 5-needle pines, requires two host plants, white pine (sugar pine, eastern and western white pines), and plants of the genus *Ribes* (currants and gooseberries). It can be controlled by destruction of the *Ribes* hosts. A *Ribes* eradication project was started in 1942 in 150,000 acres of commercial sugar pine timber on the O & C lands in western Oregon. During the 1950 calendar year, 3,159 acres of O & C lands and national forest lands were treated with initial eradication and 226 acres with reeradication.

Insect control.—Protection from insect damage is also of paramount importance to the defense effort. Despite all efforts, insect pests take a heavy toll of timber stands each year. An infestation of spruce budworm in western Oregon and Washington built up to epidemic proportions in 1949 and threatened wholesale destruction to 2,267,000 acres of Douglas-fir forests. The control program of 1951, following those of 1950 and 1949, will have covered nearly all the critically infested areas. Lack of sufficient funds may prevent completion of the treatment on BLM lands in 1951. The 1951 program includes treatment of approximately 6,000 acres of public domain adjacent to and intermingled with lands of other agencies in the Blue Mountains of Oregon and 600 acres in the Blue Mountains of Washington. Results of treatment, which consists of spraying the infested area with DDT from airplanes, have been highly effective.

Getting the Facts

Lack of specific knowledge about the forests and woodland resources of the public domain continues to be the most fundamental problem confronting the foresters of the Bureau. Basic data are needed concerning the location and extent of the lands; the character, quality and volume of timber present; the silvicultural requirements of the forest; and economic, geographic, and other information about communities and industries partially or wholly dependent upon the timber resources.

As a result of the completion of more intensive and accurate inventories reflecting higher utilization on several O & C administrative units, it is being found possible to increase greatly the sustained-yield allowable cut for these units. If inventories for other units show the same trend, it is estimated that the annual sustained-yield cut may be raised from the present 650 million to a volume of 800 million board feet upon the completion of the inventory project.

Bureau forestry personnel in region I worked with the Roseburg Oregon Chamber of Commerce and the Oregon Forest Product Laboratory in making and publishing the results of an economi survey of the Inland Umpqua Basin in southern Oregon.

In California, type mapping of all public domain in the north coas counties was completed during fiscal year 1951 in preparation fo planning for more intensive management of the timber resource situated there.

During fiscal year 1951 a preliminary forest and woodland inventor was completed in New Mexico and Arizona. All available data pertinent to these resources were compiled by township tabulations and o individual management area maps. A status check was made of th land within these two categories.

In Alaska basic data concerning forest resources are needed so tha the Bureau can furnish facts for the information of investors who wis to consider establishing forest products industries in the Territory. A inventory of white spruce stands is needed to indicate new areas o supply for local mills now cutting out their present stands. Durin 1951 the Bureau is endeavoring to contract aerial photographic coverage of certain key areas.

Management Plans

During the fiscal year 1951 the first comprehensive forest development plan was prepared covering a portion of the Mohawk Rive administrative unit.

In Colorado and Utah a program of preparing woodland management plans for each grazing district was continued during fiscal yea 1951. The plans are simple and based on the limited basic data available to the regional forester and range managers. Provision is made t adjust these plans as additional data become available. Most of th grazing districts now have these plans which are an important ste toward providing the intermountain country with an assured suppl of woodland resources, particularly fence posts and other round woo products used for ranch structures. Since most of the woodlands ar also grazing lands, the woodland management program serves dua purposes and produces dual incomes.

Similar management plans for other regions are in preparation.

Marketing

The revenues derived from the sale of forest products from the publi domain, mainly the O & C and CBWR lands, have increased fro $4.4 million in fiscal year 1950 to $7.8 million in fiscal year 1951. Thi represents the sales of 495 million board feet in 1950 and 494 mil on in 1951. There has been an upward trend in stumpage prices uring this period which, in part, explains the increase in gross re- eipts.

An improved timber sales procedure introduced January 1, 1950, as been continued during calendar year 1951 on the O & C lands with xcellent results, enabling the same staff of foresters to place on the arket an appreciably larger volume of timber.

Briefly the procedure is this: A sales program tailored to fit sus- ained-yield plans is developed a year in advance in consultation with dvisory boards. The advantage of this procedure to the industry is hat it gives interested operators ample time to investigate tracts of imber to be marketed. It also aids the forestry staff in avoiding time- onsuming work on indiscriminate applications unrelated to a unit lan for timber sales.

For the fiscal year 1951 the advance timber sale program resulted in he sale of 395 million board feet. The average selling price for all pecies was $21.65 per thousand board feet, an increase of 78 percent ver fiscal year 1950. Receipts from O & C and CBWR lands, rincipally from timber sales, aggregated $6,717,445 in fiscal year 951.

orest Development

Improvement of growing stock with the ultimate objective of an xpanded timber yield is one of the two most important aspects of forest evelopment work. It is being accomplished by the following pro- gram: (1) Timber sales operations are concentrated in stands of over- ipe timber until such stands are replaced by vigorous young growth; (2) all timber sales contracts require practices of proven success in btaining prompt reforestation of all openings created by timber emoval; and (3) all denuded areas on which reforestation by natural rocesses appears unlikely or liable to be too long deferred, are to be eplanted.

Fiscal year 1951 marked the first time that funds were specifically ppropriated for reforesting BLM lands. In region I a particularly favorable agreement was reached with the State of Oregon for aerial forest seeding. Under this agreement the State provided BLM with supervisory personnel without cost. The Bureau had the additional advantage of the same low contract prices for seeding and rodent poisoning as the State. This resulted in considerable saving to the Federal Government because of the low-cost contracts the State has developed through its large annual seeding program. Also, under the terms of an agreement with the United States Forest Service, this agency supplies the Bureau with planting stock and certain reforestation services, at cost.

In the 1945 Polk County burn area located in the Salem forest d trict, 1,584 acres of O & C lands were baited and seeded by helicopt Several different sites and conditions were included in the area seede These will serve as experimental sites and will be checked annual as guides for future aerial seeding. An additional 500 acres we reforested with young seedlings in the Coos Bay forest district.

In view of the fact that in Oregon, Washington, and Idaho alor some 150,000 acres of BLM lands require artificial reforestation, it apparent that the surface has merely been scratched. There is urgent need for a restocking program that will bring the nonprodu ing lands back into production. Aerial reseeding is a costly operatic and hand planting of seedlings even more so, but the long-run co of permitting potentially productive land to lie idle is even greater.

The second aspect of forest development is the construction of nece sary improvements. Access roads, because of their special significanc are discussed separately. There is critical need also for the constru tion of headquarters buildings, warehouses, and transportation an communications facilities in Alaska.

Access Roads

The projected access road program of the Bureau of Land Manag ment in western Oregon is the key to making the full amount of th sustained-yield of timber from the O & C lands accessible. There i an estimated 8 billion board feet of inaccessible over-mature O & timber that could be sold and cut if necessary access roads were buil The estimated cost of the principal arteries needed to tap this timbe approximates 11 million dollars, all of which will be recovered i revenues from the timber hauled out over such roads.

Multiple Use of Forest Lands

Even though the primary functions of the forestry staff involve th managing and marketing of the timber resource, attention is also bein given to other resource values in the forest. The Bureau is proceedin as far and as fast as possible to develop and utilize such complementar resources as scenery, recreation possibilities and wildlife. All resources of the public lands are being managed with the objective o maintaining maximum uniform flow of water-yielding areas, and o protecting all sites against excessive runoff, with its attendant problems of aggravated erosion and siltation.

ADMINISTRATIVE IMPROVEMENTS

The defense emergency has placed a heavy burden on the administrative machinery of the Bureau in many ways. Some of the key ersonnel have been assisting in many defense activities such as salge drives, bond sales, and in aiding newly created agencies in getting ganized. The effect of the emergency has hit the Bureau hardest its attempt to recruit personnel to fill vacancies, particularly in the wer levels, and in its attempt to obtain necessary supplies and equipent. In spite of its additional burden the Bureau has made substanal improvements in the administrative field.

iscal Procedures

Outstanding improvements have been made in the fiscal field. The illing and collecting of approximately 80,000 accounts was decentraled from the Washington office to the regional offices, and recently to e district offices. Since this change these accounts have increased to 20,000, or 50 percent, as a result of additional oil and gas and other ases.

In decentralizing the accounting work, many procedures were reatly simplified and a number of modern accounting practices not enerally used before by the Government were adopted. These cluded the elimination of individual ledger accounts, which formerly ade necessary the maintaining of several thousand individual sheets the various offices.

Another substantial improvement was the development of the oucher and schedule of payments, which permitted the listing and ertification of 10 vouchers on 1 page, as compared to the former ethod of preparing individual vouchers for each item.

Perhaps an even more important improvement was the complete limination of vouchers on items bought by the Bureau and in lieu hereof the acceptance of certified invoices from the vendors. The ureau pioneered in this change of procedure, which has since been xtended to other Government agencies.

Another important improvement pioneered by the Bureau was the rrangement made with the General Accounting Office to perform site udits at the operating level. As part of this procedure, the Bureau nade arrangements by which the former practice of sending to the eneral Accounting Office in Washington original copies of contracts, eases, and other accounting documents was discontinued. This has aved the Bureau substantial man-hours by eliminating the work ecessary in the former procedure.

These improvements and simplification in performing the accountng job of the Bureau have permitted it, in spite of its limited staff, to ccomplish many important tasks not heretofore possible, the most utstanding being, perhaps, the maintenance of the accounts on a urrent basis. This has been the goal of the Bureau for many years.

The Bureau has also been able to prepare accounting manuals for the use of field personnel, and institute many other training techniques in the accounting field.

The Bureau was instrumental in having the budget preparation work greatly simplified—primarily by reducing requests for material from the regions to once a year. The budget presentation has been improved by reducing it more than 50 percent in volume, at the same time highlighting the important parts of the Bureau's program.

These improvements would not have been possible without the active support of the Secretary's Office and the excellent cooperation of the Accounting Systems Division of the General Accounting Office. Even though tremendous strides have been made in fiscal procedures, the Bureau is progressively continuing its efforts in this field. In the immediate future it is planned to eliminate the records of individual cash receipts by providing an additional copy of the original receipt. When this is approved, it is believed this will be the first time this procedure has been adopted to Government accounting operations.

The Records Program

The defense emergency situation has emphasized the problem of preserving as well as modernizing the Bureau's public land records system. In many cases, the records in Washington are the only existing ones and their destruction would bring chaos to the entire public land records system. The Federal Records Act of 1950 directed the Secretary of the Interior to establish and maintain an active, continuing program for the economic and efficient management of the records. In accordance with this act, and because of the importance of the Bureau's records, a Branch of Records Management was established in the Division of Administration in April. This Branch thus brings together for the first time all the record-keeping functions of the Bureau under one centralized management.

Revision and modernization of the land records system is one of the most important needs of the Bureau if it is to perform its management functions efficiently. The present land records system had its beginning in the late 1700's, and was primarily devised to provide only for a disposal program. Within the past 40 years, and with the great concentration within the last 10 years, the emphasis has shifted from disposal to management. As management operations are dependent on the land records system organized primarily for a disposal program, the Bureau's operations are often greatly handicapped and delayed. The huge volume of these records is, in itself, a handicap, as well as their age, as in many cases valuable records have almost completely deteriorated. Immediate steps must be taken if the records are to be preserved. They are being used constantly by the general public, State, county, and other Federal agencies.

Supplies-Equipment

In accordance with the President's directive, the Bureau is analyzing thoroughly all requisitions submitted by operating officials in order to conserve critical materials needed in the defense program. Inventories of office furniture, furnishings, and equipment have been strictly limited to minimum requirements. Property formerly discarded has been salvaged and repaired, permitting the return of excess property to the General Services Administration amounting to several thousand dollars. The purchase of heavy equipment has been greatly facilitated by the development of procedures permitting the regional offices to handle their own bids as far as possible. Procedures were developed whereby supplies and equipment are ordered and delivered on a monthly basis, which has eliminated considerable paper work by reducing the orders, thus permitting more efficient processing and more prompt delivery on the part of the General Services Administration. Standardization of property procedures has been undertaken in all the regions.

Management Improvement

In accordance with Title 10 of Public Law 429, Eighty-first Congress and Executive Order 10072, the Bureau has initiated an aggressive management improvement program. This provides for a Bureau-wide survey of each of the functions every 3 years. It also requires annual administrative and technical reviews for each operating division at the regional level. The program also requires a semiannual report from the regions as to the identification and solution of management problems. In addition, the monthly reports from the regions contain a section devoted to management improvement in order that this matter may be constantly kept before all operating personnel. The survey of the adjudicating function was begun this year and will be completed shortly. The management improvement report from the regions for the 6 months' period ended December 31, 1950, indicated substantial improvement in nearly all phases of the Bureau's operations. A report on this period listing the specific improvements was submitted to the Office of the Secretary under date of May 28.

Some of the major improvements under this program were made in the modernization of the regulations and procedures, particularly with respect to oil and gas leasing, small tract leasing and section 15 grazing leases. The new procedures and methods have reduced substantially the time formerly taken to handle these three types of applications, which comprise approximately 60 percent of the Bureau's work load in the adjudication field. Reports from all land offices covering a period of 4 months show that in some offices the new oil and gas leases are being issued 5 days after being filed by the applicant, as compared to periods varying in the past from 3 months to 2 years. As a part of this program a work measurement study has been conducted of all land offices. As soon as a thorough analysis has been completed, the result of this study will be published. However, sufficient information is now available to indicate that the Bureau will soon be in a position to estimate with a minimum of error the number of man-hours required by the various types of personnel to process the different categories of applications which are received in the land offices.

An intensive forms control program requiring critical analysis and review of all forms requested, including reprints, as well as analysis of the procedures and regulations prescribing their use has been found to be one of the most effective management tools in improving the Bureau's operations. Many of our most important changes have stemmed from this program.

Incentive Awards

In accordance with a Secretarial order, all of the incentive awards activities were centralized in one committee, combining the honor awards, suggestions awards, and cash awards and salary increases for inventions, superior accomplishments and savings. This action, along with the delegation to the Bureau from the Secretary's Office to take final action on a large percentage of recommendations expedited this work and made the program much more effective in emphasizing its importance in the over-all management improvement program.

During the year the committee considered 123 suggestions, 15 recommendations for salary increase awards for superior accomplishments and 28 recommendations for service honor awards. The committee approved suggestions awards in 20 cases out of 70 on which final report was made. Eight salary increases for superior accomplishment were approved, averaging $138 per employee. Fourteen meritorious service awards were approved and 12 commendable service awards.

Personnel Management

The Bureau made important strides in its personnel management program, particularly in the field of employee-employer relations and in orientation and training. The decentralization of authority to the regions to hire employees in grades up to and including GS–7 has assisted the regions greatly in their recruitment program. Substantial progress was made in the reclassification of positions and bringing them into line with the organizational studies which have been conducted. A review of all personnel actions by the management staff facilitated the maintenance of proper organization structure. As a part of the training program there was an increase in the interchange of selected personnel between the Washington and field offices. During the period covered 21 employees in the field were brought into Washington, while at the same time 16 Washington employees were detailed to the regions. It is planned to develop this program to a greater extent in the immediate future, as its value has been thoroughly demonstrated.

Another important part of the Bureau's training program was the Second Resources Management Field Conference held in September at the Squaw Butte Ranch and Livestock Experiment Station which was participated in by 48 Bureau employees and representatives from other Government and State agencies. Two Bureau employees received fellowships in the Littauer Graduate School of Harvard University. These fellowships are offered by the Conservation Foundation for the purpose of providing advance training in public administration of natural resources.

Average employment of all types of employees except District Grazing Supervisors was 1,221. Average employment in the Washington office was 206, and in the regions as follows: Region I, 262; region II, 143; region III, 196; region IV, 175; region V, 130; region VI, 15; region VII, 95.

PUBLIC LANDS LEGISLATION

Two laws enacted by the Eighty-first Congress in the early part of the fiscal year are of special interest to efficient public land management. Public Law 644 provides that a more equitable return to the Bureau for the work it does in preparing copies of documents on private orders and Public Law 744 facilitates the disposal of materials such as sand, stone, and gravel from the reserved school sections in Alaska with the proceeds going to the Territorial Treasury.

Included among bills pending before the Eighty-second Congress are: a bill to except temporary employees of the Bureau from restrictions on holding public lands. This would enable the Bureau to utilize persons who are available but are now ineligible for employment in such positions as fire fighters, grazing district advisory board members, temporary survey aids, etc.; a bill to amend the Materials Act to permit easier and quicker procedures in sales of materials such as timber, sand, stone, and gravel on the public lands; a bill to provide for the classification of lands in Alaska which would aid in the proper development of those lands and of their resources; a bill to permit the leasing of boat and ship land-sites in Alaska; a bill to provide for the recordation of outstanding land scrip rights so the Bureau may formulate a program for satisfying them; a bill to repeal a number of obsolete timber laws; and a bill to broaden the law which now provides for the lease and sale of land to public bodies for recreational purposes.

The Bureau has prepared for the House Committee on the Judiciary extensive comments on the current applicability of laws now collected in Title 43 of the United States Code and of public land laws on other titles in order to assist the committee with its editorial revisions of the code.

Litigation

During the past year a number of legal problems were closely related to defense efforts. Among the more significant of these is the effort of the Bureau of Land Management and the Department to secure better utilization of natural gas and electric power through enforcement of the law requiring that natural gas pipelines crossing public lands be operated as common carriers and of the regulation which requires that the Government be given the opportunity to use any excess capacity, at its own expense, in power transmission lines crossing public lands. The efforts in both fields have been resisted by the companies involved and at the close of the year lawsuits were pending on both issues. Another legal item of interest is a Solicitor's ruling recognizing the Bureau of Land Management's statutory authority to sell gypsum and other important minerals in situations where disposal under the mining laws is prevented by law.

Legal Opinions and Memoranda

Among the more important legal problems considered by the Bureau during the year, other than those previously discussed, were the giving of full effect to the Department's current authority to accept contributions toward the administration of the public lands, the review of draft material relating to public lands for the President's Water Resources Policy Committee, the consideration of the extent of the Government's rights to water on the public lands, the continuation of the monthly supplements to the legal monographs dealing with the adjudicating functions of the Bureau which are performed in the field, the relationship between the loan standards of the Defense Minerals Administration and the standards for determining the validity of mining claims, the legality of mining claims located in Alaska for gravel on valuable school lands and segregated public lands, the preparation and approval of the deeds conveying lands from the Choctaw and Chickasaw Indians to the United States in return for an $8,500,000 payment, and the effect of asserted Indian and aboriginal claims to various areas of public lands.

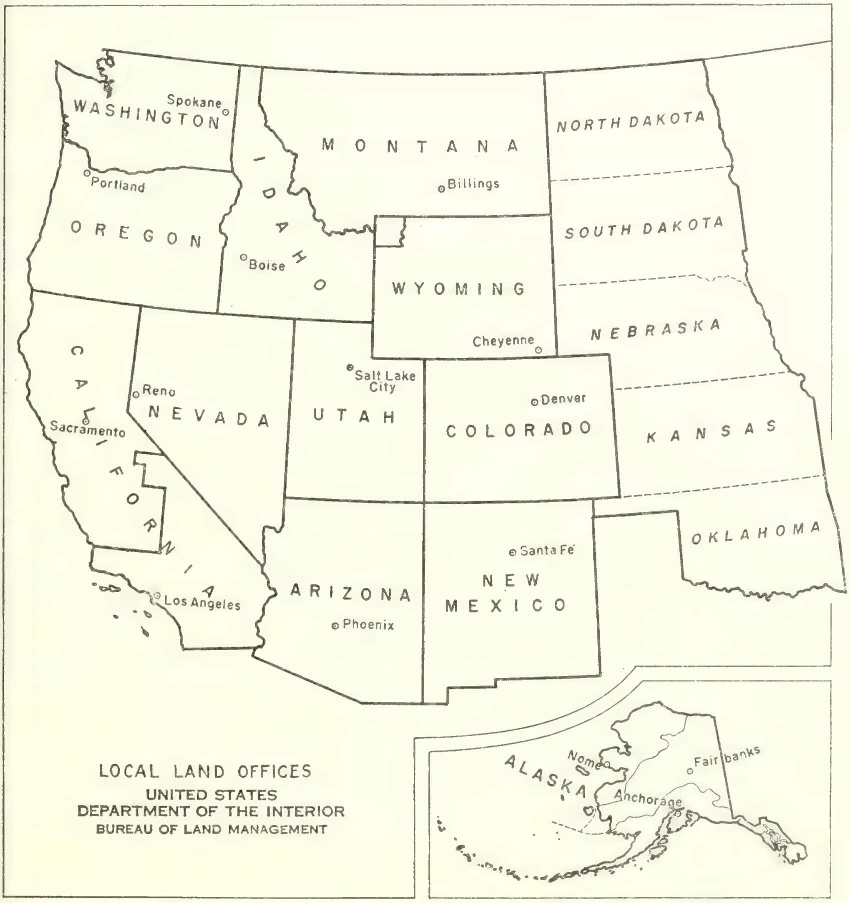
REGIONAL REPORT HIGHLIGHTS

Because many activities have been decentralized to its 7 regional offices, the following highlights from headquarters covering 29 States and the Territory of Alaska provide an appropriate summary to the Bureau of Land Management report.

Region I, Headquarters, Portland, Oreg.

Region I of the Bureau of Land Management during the past year intensified its activities in the administration of some 29 million acres of Federal lands in Idaho, Oregon, and Washington. The land-management program has helped the Pacific Northwest grow at the same time that Federal forest, range, watershed, and other values have been maintained and improved.

The timber resource managed by region I, comprising 3.2 million acres of O & C, Coos Bay Wagon Road, and forested public-domain



lands, is a vital element of economic strength. A full discussion o these lands is given under the forestry section of the report.

The administration of the logging road right-of-way regulations the O & C access road program, and other forest policies has required a heavy work-load of legal studies and negotiations which are paying dividends in the form of rights and agreements on behalf of the Government to enhance the accessibility of the Federal timber.

Advisory boards in both the O & C and grazing areas were again an asset to the region's program. They brought advice and constructive criticism which was valuable to guide administration, and served to help interpret the Bureau's program to the groups they represent and to their communities.

To adjust range use to the carrying capacity of the range, each of the 10 district range managers selected an area to be given priority in adjudicating and apportioning the range. In the Gooding-King Hill area of Idaho District No. 5, an emergency reduction of 1 month's use in 1950 was appealed by the stockmen, but was upheld by the Examiner, Director, and Secretary. With cooperation of the District Advisory Board an agreement for use was developed.

An allotment of $51,000 in special range reseeding funds was used mainly for reseeding halogeton-infested areas in southeastern Idaho. Experimental methods are being followed in range reseeding work to lay the foundation for an accelerated program.

The Squaw Butte-Harney Range and Livestock Experiment Station continued its basic research on methods of management and use of rangeland, forage crops and livestock, and served as the site of the annual Bureau-wide resource management training conference.

The region's cadastral survey program continued to emphasize the original monumentation of highly valuable Forest Service and BLM timberlands in western Oregon, with some progress toward remonumentation of old surveys elsewhere in the region.

Progress was made and additional groundwork was laid toward land planning activities, including a start on several small-area land classification surveys, improvement of individual tract classification procedures, and guidance of program planning and interagency operating relationships. The demand for individual tracts is increasing, adding to the difficulty of overcoming the accumulated backlog of land cases. The backlog of mineral examination work was increased by new requests from the Forest Service requiring extensive area examinations in Oregon and Washington.

The over-all regional adjudication backlog was decreased substantially during the year, although new and reactivated cases were received at a higher rate than in 1950.

Region II, Headquarters, San Francisco, Calif.

First consideration was given to protection, conservation, and use of maximum forage resources within sound policy of range management practices.

Oil and gas leasing activity increased in California and in Nevada assumed boom proportions with over a million acres put under lease during the year.

Nearly 14,000 cases were closed in the 3 land offices with a net reduction of over 3,000 cases, which brought the number of pending to less than 7,000 or about a 6-month workload basis.

Microfilming of survey plats and records was completed for all of Nevada and most of California. These microfilm records will be made available for public use at the respective land offices during the next fiscal year.

Interest in the small-tract program increased with a substantial number of leaseholders making application for purchase following completion of their homes.

Sales of timber were more than doubled during the year, with other materials, mostly of defense nature, made available in considerably increased quantities.

There was considerable stepup in services of the regional counsel as a result of work on mineral and grazing hearings and liaison with the National Park Service and the Forest Service.

Region III, Headquarters, Billings, Mont.

The Land and Survey Office at Cheyenne, Wyo., and the Land Office at Billings, Mont., as well as the regional office of the Division of Adjudication, have continued to process expeditiously all forms of application for use or disposition of the public domain and related resources. This work is now operating on a current basis.

Cadastral resurveys were made for the identification of oil and other mineral leases covering 115,000 acres being administered by the United States Geological Survey in the State of Wyoming. Thirty-five thousand acres have been surveyed in and adjoining national forests near Boulder and Basin, Mont. These serve the multiple purpose of identifying timber sales, range improvements, and also the identification of mineral claims and tracts of public lands being extensively prospected for uranium.

During fiscal year 1951, a total of 870,660 acres were resurveyed on reclamation projects in this region. Of this total, 364,800 acres were resurveyed in Montana; 332,400 acres were resurveyed in South Dakota; and 173,460 acres were resurveyed in the State of Nebraska.

A small-tract survey was made in the Worland, Wyo., area covering 50 small tracts in connection with a low-cost housing project. Plats of the survey of 157 homesites near Rawlins, Wyo., 50 cabin sites on the shores of Lake Hattie near Laramie, Wyo., were filed during the year.

Under the comprehensive program for the development of the resources in the Missouri River Basin, carried on by the Department of the Interior, the examination and classification was completed of 1¼ million acres of public-domain lands located principally in the Powder River and Bighorn River Basins, Wyo., and in the Upper Missouri River Basin, Mont. Four land-planning and classification reports were published; one describing the Bighorn Basin in Montana and Wyoming, one covering the public lands in the State of Kansas, a third covering public lands in the White and Niobrara River Basins in Nebraska, South Dakota, and Wyoming, and a fourth considering the watershed aspects of the Cheyenne River Basin in Wyoming. A detailed land-classification report was also made on the watershed of the Glendo Reservoir on the North Platte River.

Statistical tabulation of federally owned lands by States is complete for Wyoming and 70-percent complete for Montana.

Mineral investigations were concerned with bentonite, chromium, gold placer, and other claims.

More productive use of water and maximum productivity of grass are special points of this year's soil and moisture conservation program. Throughout the region emphasis has been placed upon the trapping of wasted range runoff waters and the conversion of these to beneficial use.

A tentative survey of halogeton indicates that this poisonous plant has scattered through some 400,000 acres but does not cover more than 2,000 acres in any degree of concentration.

National defense has increased emphasis on timber sales. Heavy sales applications have precluded field work on timber inventories and management plans. Defense planning in cooperation with the Forest Service and other Federal agencies highlights BLM's fire organization.

Region IV, Headquarters, Salt Lake City, Utah

During the fiscal year, region IV's long-range program in the conservation of water and mineral resources was submitted to the Colorado River-Great Basin Interior Field Committee.

Detailed studies were initiated in the Arkansas River Basin and erosion conditions, land-use capabilities and vegetative types were mapped on 225,000 acres.

Evaluation engineers of the Bureau spent considerable time in field studies of mining claims on lands withdrawn for the Dugway Proving Grounds. This project has high military priority in connection with the current war situation. Cadastral surveys are also in progress in the Dugway Proving Grounds.

In Colorado, requested cadastral surveys were completed on the Granby Dam and Reservoir and the Shadow Mountain Reservoir units of the Big Thompson reclamation project. Cadastral surveys were in progress at the end of the fiscal year on the Willow Creek Reservoir and the West Portal Road, at the request of the Bureau of Reclamation.

Cadastral surveys are in progress in southwestern Colorado and southeastern Utah, initiated at the request of the Atomic Energy Commission, and this work is a direct vital contribution to defense.

During the year cadastral planning and programing were intimately integrated with the plans drawn up for the development of the Colorado River, the Missouri River, and the Arkansas-White-Red Rivers.

In the land offices, applications for oil and gas leases continued in increasingly large numbers. The Salt Lake office averaged 184 new applications for lease and 39 reactivated cases each month, while the Denver office averaged 119 new applications and 57 reactivated cases each month. Applications for homesteads and public sales are still being filed in large numbers.

The regional backlog of all open cases will be reduced during fiscal year 1951 from 7,625 on July 1, 1950, to approximately 5,500 on June 30, 1951.

Region V, Headquarters, Albuquerque, N. Mex.

In January 1951, region V intensified decentralization by setting up in its 10 grazing districts a system of area administration designed to broaden the authorities and responsibilities of their personnel. So far, emphasis in this direction has been placed on sharing with the regional office personnel, the soil and moisture conservation and range improvement planning, the making of land classification investigations and reports and on full execution of the S&M and R. I. programs.

The newly established grazing district, New Mexico 7, bordering the Navajo Reservation on the east, has progressed amazingly well as regards general administration and collaboration with the Navajo Service, since many Navajo families living outside the reservation are involved. The area, unfortunately, is in the grip of an extended drought and accordingly, in consideration of an absence of range forage, all grazing fees for the fiscal year 1951 up to May 1, 1951, have been waived, and for that matter extension has been allowed until the drought breaks.

Deeds for the conveyance to the United States of the segregated coal and asphalt lands in southeastern Oklahoma were executed by the Governor of the Chickasaw Nation and the Principal Chief of the Choctaw Nation Indian tribes. The Indians received $8,500,000 for their coal and asphalt lands, which fulfilled an obligation of the United States to the Indians under the Atoka Treaty of nearly 50 years ago. Under the congressional authority for the acquisition of the lands, the lands became a part of the public domain, but the use of the land was limited to oil and gas and asphalt leasing. This posed an immediate problem of the proper use of the surface lands included in the coal and asphalt subsurface resources which were reconvened. Considerable study of this problem resulted in the recommendation of legislation which the region concluded was essential for this purpose. These recommendations were submitted to Washington. In the meantime, surface use is being authorized by special land-use permits.

Agreement was reached and field work and report on the long-pending New Mexico-Forest Exchange Applications, commonly known as "New Mexico 2–21," were completed to the satisfaction of the State, the Forest Service and the Regional Office of BLM; and the applications are pending adjudication and final consummation by the Washington office.

Region VI, Headquarters, Washington, D. C.

This region, with jurisdiction over 13 States extending from the Canadian border to the tip of Florida and from the Atlantic Ocean to one tier of States west of the Mississippi River, spans in geographical area approximately one-third of the United States. Because the public domain lands are located in the most densely settled part of this country, there is at all times a great demand for them.

During the past fiscal year this region has been able to make a substantial contribution towards national defense by screening the public lands in the coastal and other areas most suitable therefor, and arranging for the use thereof by the Army, Navy, and Coast Guard.

In Florida and Alabama, new subdivisions were opened up to meet the increased demands for individual homesites under the Small Tract Act.

The region actively participated in the current studies being made for the better utilization of the resources within the areas of several river basins.

Many conferences were held with the representatives of other Federal agencies looking to the transfer of public domain lands for such purposes as additions to national forests, national parks, and fish and wildlife refuges.

Region VII, Headquarters, Anchorage, Alaska

Residents of Alaska are living and working in an area which is on the defense perimeter of our country. The occasional boom of a heavy gun and the rattle of smaller arm fire on the several military reservations does not cause the surveyor to miss a stroke as he hacks a straight line through the brush, but the foresters watch the distant hills apprehensively for the tell-tale wisps of smoke that could mean the start of a crackling forest fire.

The Bureau of Land Management has the larger of the two fire organizations in Alaska, and is therefore charged with preparing not only its own but also an over-all civil defense operational wildland fire plan for the Territory. The widespread fires which plagued Alaska until December 1 brought out the realization that fires must be controlled and extinguished. Smoke prevents airplanes from flying, and airplanes must fly in Alaska. Over 2 million acres were burned over in the Fort Yukon area alone during the drought months of the year.

The acquisition of two more airplanes, making a total of three, and the improving of radio communications through the acquisition of military salvage has made the Division of Forestry a harder hitting fire suppression organization.

The tremendous demand of the military for building materials is accelerating in importance the sale of timber for local needs of the civilian economy and stressing the importance of conserving the timber resources on the public domain.

In the field of land use and planning, hundreds of thousands of acres of land in various parts of Alaska have been made available for the exclusive use of the Department of Defense for military installations, maneuver areas, bombing and artillery ranges, radar installations, air bases, and communication centers.

Numerous conveyances of land for development of airports and air navigation sites have been expedited.

Vital contributions have been made to the settlement and development of Alaska. More than 700 small tracts have been made available in the Territory, 600,000 square feet of commercial and industrial areas were sold at Anchorage, 141,000 acres of grazing land at Kodiak Island, Sitkinak Island, and the Knik Hay flats near Palmer have been made available under leases, unneeded shore space reservations were eliminated for several hundred miles of shoreline in the Susitna and Tanana Valleys and on other waterways.

Lots in 5 townsites were being sold during the year and arrangements were almost complete for selling lots in 10 others. The selection of lands and townsite designs have been completed for three townsites still in the planning stages.

Over 1,000 cases involving applications under the public land laws were investigated.

Land was rapidly being put into private ownership as more than 425 final certificates were issued by land offices during the year. More than 395 oil and gas cases were handled by the Anchorage land office, and the Division of Cadastral Engineering, the region's status office for unsurveyed land, and were approaching the actual lease stage at the end of the year. Development of the area covered by these applications will be started immediately as oil company men are already on the ground.

Reports were completed as to BLM plans for administering 125,000 acres of land that is to be eliminated from national forests in Alaska.

Aboriginal claims are beginning to complicate the disposal of public lands, particularly in southeastern Alaska.

The cadastral survey work has been directed principally to projects of a high priority nature during fiscal year 1951, in order to satisfy immediate needs, so that congested or essential areas could be properly administered. The demand for this work resulting from the rapid expansion of commercial and private holdings, as well as those of military and other Government agencies throughout the Territory has caused the retarding of the execution of an orderly system of planned surveys through general extension of the rectangular net. The tremendous importance of cadastral surveys in Alaska cannot be overemphasized as title to no public domain can be vested in private hands without surveys. The Territory of Alaska cannot get title to land upon which airports are planned without surveys. The small tract act, which is one of the most useful vehicles for settling Alaska, cannot be invoked on unsurveyed land. Therefore, the settlement of Alaska, which often has been quoted as a must in the defense plan for the Territory has great dependency upon the facility with which surveys are conducted.

The Division's regional office in Juneau received and plotted approximately 500 oil and gas lease applications and 450 notices of settlement or location, and made status reports as to conflicts with other surveys, withdrawals, shore space reservations or other reasons for objection to the allowance of the entry.

Fish and Wildlife Service

Albert M. Day, Director

WITH FOOD AS ESSENTIAL AS GUNS in the mobilization program, the Fish and Wildlife Service has emphasized its food-related activities during the past year, particularly those pertaining to the commercial fisheries which supply not only valuable food but also a great number of byproducts. In 1950 the commercial fishery catch of the United States and Alaska amounted to 4.9 billion pounds. Nearly one-half of this catch is used in the manufacture of byproducts such as fish meal, oils, and shell products for animal feeding; vitamin-bearing medicinal oils; and industrial oils used in the manufacture of paints, soap, oilcloth, linoleum, and printer's ink—all of value in wartime.

There has been no letup in the Service's efforts to administer the Alaska salmon fisheries so as to yield a maximum stable production both for military and civilian use. The west-coast fish hatcheries have continued to plant young salmon which are the seed stock for continuing Columbia River runs. The Service has pushed more vigorously than ever the so-called Lower Columbia River development program (a vast undertaking designed to offset the damage to the salmon fisheries arising from the construction of hydroelectric dams).

Through the cooperative program which the Service spearheads for the control of destructive predatory animals and rodents, American stockmen and farmers are able to produce from 10 to 20 percent more meat and wool in the more important meat-producing areas of the country than would be possible otherwise. This extra margin of production helps the Nation to keep its own defense workers and fighters on a high caloric diet while sending large quantities of food to other nations engaged against the common enemy.

The 99 Federal fish hatcheries continued to propagate and release game fish in streams and lakes throughout the country for the benefit of those who find their best relaxation with rod and reel. Priority is being given to the stocking of waters near military reservations and veterans' hospitals because of the recognized value of fishing as a morale booster for disabled veterans and men in training.

As in World War II days, the Service has devoted considerable time to realining many of its programs to provide maximum assistance for the national defense while continuing to discharge normal responsibilities. While priority, of course, is being given to defense requirements, we hope to maintain our wildlife refuges and our fish hatcheries and to continue the research, enforcement, predator control, and other functions essential to wildlife and fishery conservation. These programs must go forward not only in the interest of maintaining essential commercial supplies of seafood but to preserve recreational resources of fish and game during and following this period of national emergency.

UTILIZING THE FISHERY RESOURCES

With the advent of a national emergency situation, investigations dealing with exploration, development, and utilization of the Nation's commercial fishery resources were pressed vigorously during the year. Activities of the Service's exploratory fishing vessels have been varied and widespread. The exploratory fishing vessel *Oregon*, operating in the Gulf of Mexico, demonstrated the existence in the late summer and fall of hitherto unused fishable concentrations of large brown-grooved shrimp in depths of from 30 to 50 fathoms off the coasts of Alabama, Mississippi, and Louisiana. The exploration is not yet complete. Additional work is in progress to cover the remainder of the Gulf waters adjacent to the United States and to obtain some idea of the seasonal fluctuations in concentrations of shrimp.

The vessel *John N. Cobb*, based at Seattle, Wash., completed a 4-month survey of albacore tuna in the fall of 1950. Extensive gear tests indicated that albacore could be taken in commercial quantities with gill nets, a type of gear new to that fishery. Two exploratory shellfish cruises to southeastern Alaska resulted in locating unfished shrimp populations in inland waters adjacent to the areas of Sitka and Juneau. Excellent catches of pink and other species of shrimp were made in limited areas using conventional trawling gear and traps.

In New England a survey of the commercial possibilities of bluefin tuna is under way. A Pacific-coast type purse-seine vessel will be used in a 4-month operation to determine availability to the fishing industry of bluefin tuna in these waters. Simultaneously, another project was started on the south Atlantic coast to investigate the practicability of commercial fishing for the "little tuna." A preliminary survey indicated that these tuna are present at various times of the year over a wide range of the Atlantic and Gulf coasts and may be a new source of food from the Nation's expanding fisheries.

Research on fish refrigeration was emphasized in an effort to improve the quality of the fish landed in New England ports. A proposed new method of handling these fish at sea will be tested on a commercial scale. For this purpose a surplus Government trawler was obtained and is being reconditioned and equipped with fish-handling and refrigeration machinery. Laboratory tests have indicated the superiority of fish fillets prepared from fish frozen whole immediately after catching for later defrosting, filleting, and refreezing ashore as compared to fillets prepared from fish handled in the usual manner by gutting and icing aboard ship. The first commercial-scale tests will begin in the summer of 1951.

A full-scale commercial test of a recently developed chemical method of preserving salmon eggs for fish-hatchery food will be made during the 1951 season. Practical commercial methods for collecting and shipping frozen salmon viscera from Alaska to fish hatcheries in the United States will also be tested.

With the inauguration of the national-defense program, the importance of daily fisheries information on production, marketing, distribution, and prices collected by the seven field and the Washington offices of the Fishery Market News Service has become increasingly evident. During the year, plans were made to realine current coverage to meet the needs of the emergency program. This unit rapidly collected, tabulated, analyzed, and distributed through the use of daily reports, monthly and annual summaries, and the monthly periodical Commercial Fisheries Review, market information and news (including directives of defense agencies) of interest to the fishery industries. A continuous daily and summarized record of fishery production and marketing data for the principal areas is provided by these reports. They are used by the fishery and allied industries; by governmental agencies and institutions in conservation work; by financial firms in granting loans for fishery enterprises; by legislators; by fishery-research organizations (governmental and private); and for determining the economic importance of the fisheries.

Under the present emergency situation the accumulated data are proving of inestimable value to the governmental defense agencies in determining the place of the fishery industries in the Nation's emergency food program; in establishing allocation of scarce materials to these industries; and in determining ceiling prices for fishery products and byproducts.

Likewise, general fishery statistical surveys were conducted covering all sections of the United States having commercial fisheries of any importance. The last year for which a complete survey of this type was made was 1931, although surveys have been made in all areas except the Mississippi River in various years since then. Monthly and annual bulletins on the landings of fishery products in Maine and at the principal Massachusetts ports, and monthly bulletins on the landings in Texas were continued. In cooperation with the various State conservation agencies, publication of monthly data on landings of fish and shellfish in Florida, Alabama, and Mississippi was initiated. Compilation and publication of monthly statistics on the freezings and holdings of fishery products and on the production of fish meal and oil were continued.

In accordance with the authority vested in the Department by the Fishery Cooperative Marketing Act of 1934, numerous fishery cooperative marketing associations throughout the United States were visited and reports made concerning their condition and activities. As of May 1951, there were 73 active fishery cooperative marketing associations in the United States as compared to 75 in May 1950.

Aid was given the fishery industry in cases involving transportation rates or charges brought before Government regulatory bodies. Exhibits and testimony were prepared and submitted to show the effect on distribution of fishery products of proposed changes in transportation rates and charges in dockets Ex Parte 175, Ex Parte 177, and I & S 5804 before the Interstate Commerce Commission, and docket 702, Sub. 1, Sub. 2, and Sub. 3, before the Federal Maritime Board.

During the year, a fisheries adviser to the Department's representative on the Trade Agreements Committee and the Committee for Reciprocity Information was designated to assure coverage. Responsibilities in this field as well as in the entire field of tariffs and international trade in fishery products were assumed.

The home economists of the Service conducted 170 fish-cookery demonstrations for homemakers, institutional managers, educational groups, and school-lunch supervisors. A project to promote the use of fishery products in the national school-lunch program was carried out in 11 States. In previous years this activity had been confined to coastal States but now has been extended to 4 inland States also. Surveys made after the demonstrations proved that there had been a large increase in the consumption of fish by the children in the schools of these States.

Special monthly reports on the fishery supply situation have been provided to national restaurant, food-chain, and fishery associations. A quarterly market-outlook report also was released for the guidance of Government organizations and the trade in planning and developing fishery activities.

One educational motion picture was produced in cooperation with industry. The menhaden industry financed the project, while the Service was responsible for production and distribution of the film.

This picture, The Story of Menhaden, in color and with sound, has been chosen for showing in the two European film festivals. Three Service fishery educational pictures have been cleared for showing on television and were televised over 200 times during the past year. In addition to the regular distribution channels, the Service's educational films are distributed through 65 film libraries, mainly in universities.

ADMINISTRATION OF ALASKA FISHERIES

Management of the Commercial Fisheries

While having contributed substantially to the Nation's food requirements for more than 80 years, including two world conflicts, the fishery resource of Alaska continues as the Territory's major industry. Accounting for 90 percent of the annual 100-million-dollar fish harvest, the salmon runs of "silver horde" fame require ever-increasing restrictions to safeguard their continuing contributions. The increasing pressure of commercial exploitation emphasizes the need for greater effort in enforcement, and sound, long-range planning so that this resource may be kept at a high level of production to fulfill current requirements and at the same time provide sufficient reserves to meet any national emergency.

Within limits prescribed by statute the revisions of the regulations, effective for the 1950 season, were promulgated on March 4, 1950. The provision for the late opening of the pink-salmon season in southeastern Alaska, which had produced such favorable results in early escapements to the spawning grounds last year, was continued in order to cover the second cycle of this species. The results, however, were disappointing, as the runs in 1950 were the poorest in years. As a result of a tremendous influx of gear, it was necessary to curtail the Cook Inlet fishing season at its height to provide for the required escapement of spawning fish to the Kenai River, one of the important runs in this district. Curtailment was made in the offshore trolling season to coincide with that permitted by Oregon, Washington, and California under the Pacific Marine Fisheries Commission's plan. Postponement for 1 year of a change in regulations to permit power gill-net boats in Bristol Bay, headed the list of other changes, mostly minor, for 1950. As part of the regionalization of the Fish and Wildlife Service's field activities, certain key personnel in the Alaska region, trained in fisheries, were delegated authority, within prescribed guide lines, to control the take of salmon by shortening or lengthening seasons by field announcement as conditions required. Fifteen such announcements were issued for this purpose during the season.

Twenty-one permanent fishery-management biologists and enforcement agents, of whom 6 were on detail from the States, were active in Alaska during 1950. In addition, approximately 100 temporary, seasonal assistants and stream guards, together with about 13 temporary enforcement personnel of the Territorial Fisheries Board, augmented the permanent staff in enforcement of the fishery statutes and regulations. Seven seagoing patrol vessels, 15 speedboats, and more than 60 outboard-powered small craft, together with 13 aircraft, provided the transportation required in management and enforcement activities. Aircraft patrol accounted for almost 60 percent of the violators apprehended. A total of 180 court actions were brought against the individuals apprehended, resulting in 164 convictions, 12 acquittals, and 4 dismissals. Fines, forfeitures of bonds, and proceeds of sales of confiscated fish totaled over $46,000. In addition, jail sentences of 3,251 days were meted out, of which 2,025 were suspended. Forfeiture of gear totaled 230 fathoms.

To assist in securing full compliance with the statutory requirement that there be at least a 50-percent escapement of salmon to spawning waters, 16 counting weirs, of which 7 were in southeastern Alaska, 2 in Cook Inlet, 4 in Kodiak, 2 in Bristol Bay, and 1 in the Chignik area, were operated during 1950. The weirs also furnish precise information on the time of arrival and duration of the runs of the several species. In addition, four migrant or downstream sampling weirs were maintained in southeastern Alaska to obtain data on the hatch and survival of pink salmon from the spawning of the preceding year. In continuing the stream improvement which has been under way for several years, more than 100 obstructions, mostly beaver dams, were removed from spawning streams entering Cook Inlet.

Pribilof Islands Fur-Seal Industry

A total of 60,204 fur-seal skins was taken on the Pribilof Islands in 1950. These included 60,090 obtained during the regular summer sealing season, and 114 from animals killed for research purposes between September 8 and October 3. The 1949 take, by comparison, was 70,991. Twenty percent of the 1950 production of sealskins was delivered to the Canadian Government under the terms of the Provisional Fur-Seal Agreement of 1942 with Canada. The byproducts plant on St. Paul Island produced 340 tons of fur-seal meal and 42,000 gallons of oil. One ton of meal was transferred to the Fur Animal Experimental Station of the Department of Agriculture at Petersburg, Alaska. The remainder of the meal and the oil was sold through competitive bidding for the gross amount of $72,869.10.

Foxing operations were suspended on the islands during the 1949–50 season, owing to the poor demand and low prices for blue-fox pelts.

Two public auction sales of fur-seal skins were held at St. Louis, Mo., during the fiscal year ending June 30, 1951. A total of 25,697 fur-seal skins was sold on October 9, 1950, for the gross amount of $2,454,515. At the same sale 279 Pribilof Islands fox pelts brought $2,412. On April 9, 1951, there were sold 25,740 Government-owned seal skins for the gross sum of $2,591,796.

RESEARCH IN FISHERY BIOLOGY

River Fisheries

Studies of pink salmon in Alaska revealed that temperature of the water in the streams influences greatly the time required for salmon eggs to hatch and, therefore, the time when the young salmon go downstream to sea. Also it has much to do with determining the rate of infant mortality.

By marking experiments, biologists have been charting routes of migration of the adults in the intricate passes from the sea to their spawning streams. They are also studying the various elements of the environment that may affect the survival of pink salmon during their ocean sojourn.

At a small lake near Karluk Lake, a pilot experiment was conducted to estimate the value of fertilization for increasing production of food for young salmon. Results look promising and are being followed up.

By tagging hundreds of shad at the mouth of the Hudson River, Service biologists have been able to estimate the total run of shad entering the river. The spawning area in the Hudson has been defined and the abundance of young shad estimated. The 5-year shad investigation, authorized by Congress in 1949, includes concentrated work in successive areas proceeding southward from the Hudson and including some North Carolina rivers.

Although the scales of shad, as of other fishes, show annual marks, scientists had previously been able to interpret them only in terms of number of spawning seasons. Now, thanks to a method developed at the Beaufort, N. C., laboratory, total age can be determined. This important contribution makes it possible to obtain the essential information for measuring mortality rates, hence for designing means of rehabilitating the low-ebb shad runs along the Atlantic coast. The shad-producing States of the Atlantic seaboard, through the Atlantic States Marine Fisheries Commission, are cooperating with the Fish and Wildlife Service in this investigation.

Inland Fisheries

At the end of the second year of the investigation of the sea lamprey in the Great Lakes, the Service held a more optimistic view about the control of this parasite than appeared justified a year ago. Studies have shown that there are three vulnerable periods in the life history of the sea lamprey, (1) when the adults enter the streams to spawn, (2) during the three or more years the larvae live in the mud of the stream, and (3) when the newly transformed lampreys move downstream to begin their parasitic lives in the Great Lakes. Mechanical control devices (weirs and traps) were used exclusively during the first year to capture upstream and downstream migrating lampreys. During the second year the same weirs were used primarily as checking structures for testing other experimental control devices and for controlling lampreys on an experimental basis along about 100 miles of shoreline in northern Lake Huron.

A contract was awarded to the Cook Electric Co. to develop, install, and test various electric devices designed to direct movements of lampreys toward their destruction. These experiments have proved that lampreys are much more difficult to kill at given voltage levels than any kind of fish native to the Great Lakes.

Poisons are being sought that will kill lampreys but that will be harmless to other fishes.

Because adult lampreys live in very deep water, it is necessary to study in the laboratory such features of their biology as growth and the frequency and mode of attack on their victims. These studies may give clues to means of controlling the lamprey in the Lakes proper.

Tremendous over-winter losses of trout occur in most streams in the United States. In an effort to explain this loss, and to prevent it, native and hatchery trout have been stocked in four experimental stream sections at the Convict Creek Experimental Station in California. In these four sections, which have a total length of 1 mile, water flow and fish movements can be controlled. Experiments planned over several years propose complete drainage, and removal of the fish for counting each fall and spring. At the same time all features of the environment which may affect trout are being recorded, for example, stream flow, air and water temperatures, snowfall, ice formation, abundance and distribution of food animals and of enemies.

Research to improve fish-hatchery production and efficiency was expanded. New drugs and chemicals are being tested to develop better prophylactic treatments for hatchery fish. Results of experiments indicate that although sulfonamides are effective in treating several common fish diseases, they are unsuitable for others. Antibiotics, such as terramycin and chloromycetin, have been employed successfully in curing and preventing some diseases for which no cure was previously known.

Several new vertical egg incubators have been developed for saving space in hatcheries and are now undergoing tests for refinement of techniques and for any necessary structural modifications.

Marine Fisheries

The Fish and Wildlife Service, the Scripps Institution of Oceanography, the California Division of Fish and Game, and the California Academy of Sciences, with the support of the industry (through the California Marine Research Committee), are cooperating in a study of the Pacific sardine, which declined sharply in abundance after 1944. Goals of the several collaborators include a determination of the variations in the amount and in the extent of sardine spawning, in the productivity of the area, in the prevailing current patterns, and in other characteristics of the marine climate off the west coast of North America, as these relate to the sardine.

In the central Pacific, studies are being made of the far-reaching western seas not only to collect information on the ranges and distribution of the several species of tunas, but also to obtain the basic facts on the life histories and migrations of these important fishes. Because the lack of live bait for tuna fishing is the major obstacle to a greater development of the mid-Pacific tuna fisheries, one vessel is engaged in determining whether tunas may be caught with a conventional purse seine, a form of fishing gear which does not require bait.

Biologists, acting as official observers for the high commissioner of the trust territories and for the Fish and Wildlife Service, accompanied Japanese postwar tuna-fishing expeditions to tropical waters. These observers record biological, commercial, and technical features of the operations.

Cruises have just begun, and will be made each season of the year, in the Gulf of Mexico to study currents, to discover spawning areas of various fishes, and to resolve the distribution pattern of fish larvae and juveniles, consequently to estimate abundance and determine distribution of fishery stocks. A biochemical study will be made of the Gulf bearing on the problem of total biological potential, and what part of this potential can be made use of for human needs. The Office of Naval Research, through the Department of Oceanography of the Texas Agricultural and Mechanical College, is cooperating by conducting the physical oceanographic studies on these cruises.

Four experimental clam farms set out recently in Maine should determine the practicability of clam farming on the Atlantic coast. In Massachusetts, studies on growth and survival of transplanted clams in protected and unprotected plots indicate the need for biological studies on the numerous enemies of the clam. Traps have been built to study the seasonal abundance of green crabs, and their relation to the uneven distribution of clams.

At Milford, Conn., chemical compounds are being tested to find repellents, attractors, or poisons to control the common drill, enemy of oysters.

Research in Chesapeake Bay has found the supply of marketable oysters to be low except where the State of Maryland had planted seed oysters in recent years. Lack of clean hard cultch, suitable for the young oysters to settle on, contributed to scarcity of oysters in the Potomac River.

At Beaufort, N. C., the Fish and Wildlife Service under contract with the Atomic Energy Commission is applying radioactivity in studies on nutrition and other aspects of physiology of oysters and other marine animals.

MAINTAINING THE INLAND FISHERIES

This program is directed toward meeting the greatly increased demand for fish for stocking purposes and, at the same time, laying the groundwork for maintenance of the stock of inland fishes on a continuing basis. It is complicated by such factors as a continued increase in the population of industrial areas, depletion of forests by the lumber and pulp industries, pollution of streams, and the construction of multiple-purpose dams—factors which have greatly reduced the areas that are available for the natural spawning of game fish.

As one part of the program, Congress provided funds for continuing the construction and expansion of hatcheries in fiscal year 1950 to increase the production of fishes for stocking purposes. The construction of new hatcheries is well under way at McNenny, S. Dak.; Bald Hill Dam, N. Dak.; Millen, Ga.; North Attleboro, Mass.; and Pendills Creek, Mich. The program to enlarge and improve fish-cultural facilities was continued at the units in Berlin, N. H.; Bozeman, Mont.; Cape Vincent, N. Y.; Corning, Ark.; Dexter, N. Mex.; Ennis, Mont.; Erwin, Tenn.; Farnsworth, Pa.; Hagerman, Idaho; Harrison Lake, Va.; Hebron, Ohio; Hot Springs, N. Mex.; Lamar, Pa.; Leadville, Colo.; Meridian, Miss.; Nashua, N. H.; New London, Minn.; Quilcene, Wash.; Tishomingo, Okla.; Uvalde, Tex.; Warm Springs, Ga.; Williams Creek, Ariz.; and White Sulphur Springs, W. Va. The construction funds were supplemented by an allotment of $135,000 for the maintenance of other hatcheries not included in the extensive expansion and improvement program.

On the Columbia River the salmon fishery annually produces 32 million pounds of food fish, currently valued at 17.5 million dollars.

After the construction of Grand Coulee Dam, the Service undertook to preserve the upper-river salmon runs by transplantation to streams entering the Columbia River below the dam. After a decade of artificial propagation, this program has been pronounced a success. The return of adult blueback salmon to the Grand Coulee project is at present considerably in excess of the number ascending the Columbia to that area before the construction of the dam. Furthermore, the operations have resulted in an increase in the number of spring chinook salmon ascending to the upper Columbia River. However, very few salmon seek to pass Grand Coulee Dam; instead, they turn into the tributaries or return to the hatchery streams where they were released as fingerlings.

The construction of Shasta Dam across the Sacramento River in California posed a problem similar to that on the Columbia. In the Sacramento Valley, the program is based upon both natural and artificial propagation, but the emphasis is on hatchery operations. This program, too, appears to have been successful. Reports indicate that hatchery-reared salmon, upon their return to the river as adults, made up an important part of the total catch of the commercial fishery in the San Francisco Bay area. Each year since 1942 the production of the Coleman hatchery has been increased to maintain this run.

During the fiscal year 1951, the Branch of Game-fish and Hatcheries took over the Sacramento River Fisheries Investigation which was previously handled by the Branch of Fishery Biology. This program involves the study of environmental changes in the Sacramento River resulting from the manipulation of these waters at Shasta and Keswick Dams. As data on the migrations, spawning number, and spawning success, as well as on water temperatures and flows, were obtained from this study, the Bureau of Reclamation has been advised regarding water releases from Shasta Dam. In order to evaluate the effect of the pumping plant now under construction by the Bureau of Reclamation at Tracy, Calif., the Service has begun a study of the effect of the diversion of water in the Delta area of the Sacramento and San Joaquin Rivers. Studies of fish populations in the Delta area and of the effectiveness of various types of screens and other facilities are under way.

The program for stocking suitable waters within or near military reservations, rest-camp centers, and hospital areas with fish to provide military personnel and veterans with fishing for recreation or relaxation was continued during the year, to the limit of funds and facilities available. Although these services have necessarily been conducted on a limited basis, the results in improved morale, the rapid recovery of hospital patients, and the rehabilitation of personnel in rest-camp areas were outstanding. It is expected that this service will be expanded to provide a well-coordinated program to continue through the emergency period and for as long thereafter as needed.

The production of game fish was continued at a high level during 1950. This was accomplished at a time when production costs were at the highest point in history and operations at a number of hatcheries were curtailed because of the initiation of an improvement and expansion program. The following is a summary of the production of Federal hatcheries for the calendar year 1950.

INTERNATIONAL COOPERATION IN CONSERVATION

International Conservation Agreements

During the fiscal year 1951 the Fish and Wildlife Service has been primarily concerned with the formulation of international conservation agreements, with their implementation, and with performing appropriate functions in connection with agreements already in operation. The year has witnessed significant developments in this regard.

Table 1.—*Summary of the production of fishes and eggs by Federal hatcheries during the year ended Dec. 31, 1950*

Group	Eggs	Fry	Fingerlings	6 inches or over	Total
Largemouth black bass		1,012,995	9,194,150	15,120	10,222,265
Smallmouth black bass		759,300	349,765	1,550	1,110,615
Rock bass			1,150		1,150
Warmouth bass			710		710
Bluegill			35,229,740	16,525	35,246,265
Redear sunfish			5,060	205	5,265
Green sunfish			14,000		14,000
Channel catfish		111,730	124,230	940	236,900
Catfish			410,550	9,030	419,580
Black crappie			10,325	245	10,570
White crappie			55,355	60	55,415
Yellow perch			14,825	2,110	16,935
Rainbow trout	8,329,230		6,705,850	929,610	15,964,690
Brook trout	13,214,500	325,000	2,887,080	546,330	16,972,910
Brown trout	2,762,705		1,284,035	276,470	4,323,210
Lake trout			372,460	1,425	373,885
Cutthroat trout	15,673,540	1,620,480	4,099,100	12,005	21,405,125
Steelhead trout			261,755	1,615	263,370
Dolly Varden trout			59,410		59,410
Northern pike	2,928,000	2,390,180	1,980		5,320,160
Walleyed pike	500,000	13,403,000	28,150		13,931,150
Atlantic salmon			417,325	385	417,710
Chinook salmon	7,939,600		43,585,605		51,525,205
Chum salmon	3,412,560	5,899,670			9,312,230
Red salmon	167,155		1,462,335	28,645	1,658,135
Silver salmon	72,120		468,185		540,305
Sebago salmon			51,100		51,100
Kokanee salmon		102,000	680,540		782,540
Grayling	853,845	800,000			1,653,845
Flounder		80,069,000			80,069,000
Pollock		14,847,580			14,847,580
Lobster		398,000			398,000
Total	55,853,255	121,738,935	107,774,770	1,842,270	287,209,230

The International Commission for the Northwest Atlantic Fisheries provided for by the terms of the International Convention for the Northwest Atlantic Fisheries, which was signed at Washington under date of February 8, 1949, and entered into force on July 3, 1950, held its first meeting at Washington from April 2 through April 10, 1951. Three United States Commissioners were appointed to this Commission by the President on January 15, 1951—Dr. Hilary J. Deason, Chief, Office of Foreign Activities, Fish and Wildlife Service; Dr. Bernhard Knollenberg, author and lawyer of Chester, Conn.; and Francis W. Sargent, Director, Division of Marine Fisheries, Department of Conservation, Commonwealth of Massachusetts. The first meeting of the Commission was devoted primarily to the development of a sound organizational foundation for the future operation of the Commission. Dr. Deason was elected chairman of the Commission for a 2-year term. Five of the original signatory Governments have taken the necessary action toward ratification, namely, Canada, Denmark, Iceland, the United Kingdom, and the United States. It is anticipated that the remaining signatory governments, France, Italy, Norway, Portugal, and Spain, will take such action in the near future. In accordance with the provisions of Public Law 845, Eighty-first Congress, approved September 27, 1950, the United States Commissioners, before the first meeting of the Commission, appointed an advisory committee consisting of 14 members representing all phases of the Northwest Atlantic fishing industry.

The Convention between the United States and Mexico for the establishment of an International Commission for the Scientific Investigation of Tuna, signed at Mexico City, January 25, 1949, entered into force on July 11, 1950, upon the exchange of ratifications by the two Governments. This convention has been implemented by Public Law 764, Eighty-first Congress, approved September 7, 1950. The following United States Commissioners have been appointed by the President: Milton C. James, Assistant Director, Fish and Wildlife Service; Lee F. Payne, newspaper executive, Los Angeles, Calif.; Eugene D. Bennett, lawyer, San Francisco, Calif.; and Gordon Sloan, lawyer, Astoria, Oreg.

The Inter-American Tropical Tuna Commission provided for under the terms of a Convention with Costa Rica, which was signed at Washington on May 31, 1949, and entered into force on March 3, 1950, held its first meeting at San Diego, Calif., in July 1950, and its second meeting at San José, Costa Rica, in February 1951. As its director of investigations the Commission appointed Milner B. Schaefer, formerly a fishery-research biologist with the Fish and Wildlife Service. Although the agreement is open to adherence by other interested governments, no such adherences have taken place. This agreement was implemented by the same public law as noted above in connection with the United States-Mexico tuna agreement.

The Convention between the United States and Canada for the extension of certain port privileges to halibut-fishing vessels on the Pacific coasts of the two countries, which was signed at Ottawa on March 24, 1950, entered into force on July 13, 1950.

The International Whaling Commission held its second meeting at Oslo, Norway, from July 17 to 21, 1950. Its third meeting will be held at Capetown, South Africa, in July 1951. The President recently appointed Dr. Remington Kellogg, Director of the United States National Museum, as United States Commissioner to the Commission, and Dr. Hilary J. Deason, of the Fish and Wildlife Service, as deputy commissioner. The Department of the Interior has issued a license to a shore station in Eureka, Calif., to operate for the calendar year 1951.

International Technical Cooperation

The Service continued to give assistance to underdeveloped countries of the world under the point 4 program, administered by the Technical Cooperation Administration of the Department of State.

The fishery mission to Mexico which was established in 1942 has been in force since that time. There is urgent need for increased production of fishery products for domestic consumption in Mexico, and gratifying progress has been made in developing the fisheries of both inland and marine waters. At present, the Mexican Government and the Rockefeller Foundation are engaged in a project to increase the number and efficiency of ponds for culture of native species of fish. There has been a remarkable development of the shrimp industry in the past decade, in which production increased from 5 million pounds to 40 million pounds. In 1950, about 400 trawlers were in operation and the investment in the industry totaled 25 million dollars. Most of the equipment, machinery, and fishing gear was purchased in the United States. The present need is for formulation of a plan of management of the resource which will insure a maximum sustained yield. The mission has assisted in the establishment of the Instituto de Pesca del Pacífico, an organization financed by industry and the Mexican Government, to collect the basic data necessary for development of a program of conservation of the marine fishery resources.

In 1949, upon request of the Government of Peru, and in cooperation with the Institute of Inter-American Affairs, the Service established a mission to Peru to assist in solving numerous problems concerned with administration and management of the fish and wildlife resources. Significant progress has been made in attaining the objectives of the mission. In May 1951, two specialists were added to the staff of the mission. A fishery-products technologist will devote

6 months to the development of methods of preservation of products for domestic consumption, and train a staff of cannery-inspection technicians. A fishery biologist will advise the Government of Peru on the design, staffing, and operation of a marine-biology laboratory and exploratory vessel. The staff will study the marine resources with a view toward increase in production and improvement of facilities for preservation, distribution, and marketing.

Training of qualified students and specialists of foreign countries in several phases of biological science and management in relation to conservation continued during the year. This work was carried out under several programs sponsored by the United States Government, including that of the Economic Cooperation Administration. Visitors and trainees under these programs came from such diverse and widely separated areas as Brazil, Peru, Portugal, Finland, Thailand, the Philippines, and Japan. In addition, the Service gives assistance to many foreign visitors who visited the United States under programs sponsored by their own governments. Instruction in the principles and techniques of conservation is an important adjunct to the mission program, for it provides a growing body of competent scientists and technicians to continue projects initiated by the missions.

FEDERAL AID TO STATE PROJECTS FOR THE RESTORATION OF WILDLIFE

The Federal Aid in Wildlife Restoration Program continued the general pattern of recent years with the greatest emphasis being given to restoring and improving the habitat. This is a natural sequence, for considerable lands have been acquired and results of surveys and investigations have pointed the way to better management. The scope of activities undertaken indicates that great strides are being made in the effort to produce an annual increment of wild game birds and mammals adequate to satisfy the tremendous demands of sportsmen for recreation and food.

Habitat improvements, designed to benefit small game, were undertaken by 38 States during the year. Food and cover plantings, fencing, and construction of shallow impoundments are among the developments that were placed on private lands under cooperative agreements. Increased availability of planting stock permitted a substantial expansion in this gigantic task of furnishing the necessities of life to these game species. Nine southeastern States distributed over 30 million lespedeza plants and thousands of pounds of lespedeza seed to augment the supply of quail food and cover. The Plains States continued to expand their tree- and shrub-planting programs. Conifers and food-bearing shrubs were set out by the millions in the northern States. Multiflora-rose seedlings were planted in vastly greater numbers to serve a dual purpose as living fences and wildlife cover. Emphasis in the western part of the country was on food- and cover-producing shrubs and the providing of assured water supplies for several species of western quail. Toward that end, California completed its thousandth "gallinaceous guzzler" during the year, while six other States and Hawaii continued to build these rain-water catchments.

Upland game on State-owned lands received its share of attention in many States as the tempo of acquisition of these areas increased.

Waterfowl projects were under construction in 33 States. Development of the 15,000-acre Cheyenne Bottoms refuge and public shooting grounds in Kansas continued at a rapid pace; the diversion dam and canal were finished and construction of the outlet canal and interior dikes was initiated. Iowa's important Sweet Marsh impoundment was being rushed to completion as the year ended. Several Michigan waterfowl flooding projects were completed and others started. California continued work on several waterfowl areas, while Washington began the rehabilitation of Skagit Flats for wildfowl. Minnesota received approval to commence the development of the 53,000-acre Roseau River Refuge. Located at the international border, it involves construction of a diversion dam and canal in Canada in cooperation with the Province of Manitoba. The ultimate completion of dikes and control structures on the Minnesota side will provide some 18,000 acres of shallow impoundments for waterfowl and fur animals.

Over-browsed big-game ranges in the West, particularly wintering grounds, were reseeded to browse and forage species in an effort to bring these ranges to maximum wildlife productivity. Fencing to control livestock use was another activity undertaken to benefit big-game herds.

Trapping and transplanting of mammals and birds were conducted by 27 States. In the East, turkey, deer, and beaver were species resettled in new territories. In the West, Gambel's quail, chukar partridge, prairie chicken, turkey, antelope, deer, beaver, mountain goat, and bighorn sheep were moved to new ranges.

The acquisition of areas for wildlife purposes continued at a normal rate. Projects providing for the purchase or lease of lands were submitted by 27 States. Negotiations were started on several new areas of importance.

Research studies were in progress in 44 States, Alaska, Hawaii, Puerto Rico, and the Virgin Islands. From these fact-finding projects the game departments are obtaining information with which to manage better their wildlife resources.

After more than 10 years of urging by State technicians employed on Federal-aid investigational projects, the Wisconsin Conservation

Department was finally able to overcome public opposition to a hunting season on doe deer. In 1950 a hunter could take any kind of deer, and a computed harvest of 167,911 was recorded. Subsequent surveys revealed that the population was not reduced enough to bring about the desired restoration of depleted deer habitat. West Virginia was also successful in lifting the ban on does in certain sections of the State, and during the 1951 season the entire State will be open for deer shooting without restrictions on sex or age of animals to be harvested. It has definitely been established that better deer management is being practiced in those States where either sex can be harvested than where bucks only are legal game.

The ruffed grouse is famous as a cyclic species, and for years the theory was advanced that hunting should be prohibited during years of low population, so as to protect the remnants. An analysis of 10 years of hunting results, in Michigan, Wisconsin, and Minnesota, by Michigan technicians showed that closed seasons apparently have little influence on population recovery. Despite an interval of several closed seasons, the population rise in both Minnesota and Wisconsin did not appear to be significantly different from that of Michigan, where the season remained open continuously throughout the whole cycle. If Michigan had closed the season from 1945 to 1947 as Wisconsin did, sportsmen of the State would have lost an estimated 2 million hours of healthful outdoor recreation and a game bag of half a million birds.

Little data have been available on the migrational habits and production of waterfowl on the Alaska breeding grounds. Facts are being accumulated as a result of Federal-aid activities. During the summer of 1950, 4,738 ducks and geese were banded in the Territory, a tremendous achievement in view of travel and weather obstacles peculiar to the area. The information resulting from this effort is paving the way to a much better understanding of the movements and management of waterfowl in the Pacific and Central Flyways.

During the year, 375 State publications depicting the wide range of research accomplishments under this program were released for public consumption.

Table 2.—***Summary of penalties imposed during the year for violations of wildlife conservation laws, 1950–51***

Act	Convictions	Fines and costs
Migratory Bird Treaty Act	580	$24, 549. 00
Migratory Bird Conservation Act	37	2, 020. 00
Migratory Bird Hunting Stamp Act	48	1, 512. 00
Lacey Act	6	3, 000. 00
State prosecution from Lacey Act investigations (furs)	30	422. 65
Cooperative prosecutions in State courts	3, 383	98, 748. 50
Total	4, 084	130, 252. 15

Table 3.—***Cases of violations of the Migratory Bird Treaty Act, disposed of during the year, and cases still pending on June 30, 1951***

Disposition	Number	Pending	Number
Convictions	580	From preceding year	395
Not guilty	56	New cases	680
Dismissal	19		
Nol-pros	22	Total	1,075
Closed without prosecution	15	Disposed of during year	692
		Pending at end of year	383
Total	692		

A reduction is indicated in the number of Migratory Bird Treaty Act cases reported for Federal prosecution. In addition 1945 cases obtained by Federal agents or in cooperation with State game law enforcement officers relating to the illegal taking of migratory birds in violation of both Federal and State laws were disposed of in State courts.

RESEARCH IN WILDLIFE MANAGEMENT

The 1950 waterfowl breeding ground surveys indicated that water fowl production was up for the Central Flyway, down for the Mississippi and Pacific Flyways, and about the same for the Atlantic Flyway. Waterfowl hunting season investigations indicated the hunters' harvest to be about 17 percent below that of 1949–50. The average hunter went afield about 7 times during the season and bagged about 10 ducks, 0.4 geese, and 0.6 coots. The 1951 inventory of North American waterfowl indicated upward trends in the wintering populations of both ducks and geese.

The cooperative wildlife research unit program, in which the Service participates with the Wildlife Management Institute, the land-grant colleges, and State conservation departments, was expanded by the establishment of the Arizona unit, bringing to 17 the number of these cooperative projects. The program facilitates the training of wildlife personnel, conducts research, promotes education, and provides technical assistance to conservation agencies. During the school year of 1950, more than 300 wildlife students were graduated from Unit schools. Approximately 160 wildlife publications appeared during the year under the authorship of unit personnel. The Federal expenditure of $123,000 for the unit program was matched by several times this amount in State and private funds, supplies, and manpower.

The introduction of desert-bred game birds from the Middle East to similar localities in this country where native species are depleted is approaching realization. In 1950, Dr. Gardiner Bump, the Service's foreign game-bird specialist, spent 6 months in the desert and mountain country of Turkey, Iran, and Iraq investigating and collecting desirable species which would not be destructive to crops or native American birds. In studying these species through 18,000 miles of travel by jeep, particular attention was paid to habitats, food, general characteristics, ability to withstand predation, susceptibility to disease, relation to agriculture, and potentialities for providing good hunting. During this time he found four species—chukar, "seesee" or sand partridge, black partridge or francolin, and oriental sand grouse—worth a trial introduction in Arizona, New Mexico, and Utah. Small shipments have already been made. In 1951 much larger numbers are to be trapped by Dr. Bump and shipped for liberation on carefully selected and controlled test areas, chosen in cooperation with the game departments of each State. Selection of these sites was based on similarity of topography, water quantity, climate, and food supply to those of countries in which the birds now live. The Fish and Wildlife Service, the Wildlife Management Institute, and the State game commissions will work under a cooperative agreement insuring close scientific control for the new inhabitants. In this way the importation of foreign game birds is more likely to succeed than other large-scale attempts in the past that lacked adequate biological research and proper habitat investigation.

The section of Biological Surveys cooperated with other institutions, some of which have originated projects with the Office of Naval Research, by use of the Service study collections. Such work inolved, in part, identification of mammals of economic importance, their distributional spread, and their effect on public health.

At the Patuxent Research Refuge in Maryland, in collaboration with the Bureau of Animal Industry, a study is being conducted on parasites and other disease factors of Canada geese as they affect the wintering population at the Pea Island National Wildlife Refuge in North Carolina. The disease laboratory of the Refuge has prepared a review of the current status of trichomoniasis, a disease of the throat of mourning doves which has caused extensive losses in southeastern States. Further studies are in progress. A successful investigation on waterfowl habitat development involved Federal and State cooperation on a weed-control project in a Delaware marsh area. More than 100 test plots were established to ascertain the most effective agents and the best time for controlling two important pest plants—Hibiscus and Phragmites. Encouraged by results in the small-scale tests, the State of Delaware is now planning a large-scale attack on these undesirable marsh plants. The resulting information, to be summarized in a bulletin with other aquatic-weed-control knowledge, will be a valuable guide to the improvement of marshes in many places.

Continued studies on repellent chemicals for reducing economic losses from rodent attacks upon stored commodities have resulted in the selection of several promising materials as additives to the glue lines, as surface coats, and in plastic films. Preliminary trials have shown that rodent damage can be prevented for periods of several months, and final evaluation studies are in progress. Two of the more active protective materials were developed in the chemical laboratory at the Patuxent Refuge.

A method has been developed for the eradication of Japanese honeysuckle from plantings of bicolor lespedeza, a leguminous shrub extensively used in quail management. Cultural methods have been improved and demonstrated by which a stockproof fence of multiflora rose can be grown in 3 years, even on extremely poor sites. Rugosa rose, a native American species, is being tested for use as an attractive farm hedge, and various planting patterns of other deciduous shrubs are being observed for their value as wildlife cover. Simplified methods for maintenance and the increase of seed production in bicolor field borders and food strips for quail are being developed in cooperative work with the regional office of the Soil Conservation Service in the Southeast. Managers and owners of 12 quail preserves are cooperating in a program for the improvement of habitat-management measures for this species.

Studies on the nutritional requirements of quail and pheasants are being continued and an up-to-date book on the pheasant is being compiled for publication by the Wildlife Management Institute. An ecological investigation of the pheasant has been established for a determination of regional limitations and requirements.

Hazards to wildlife which may be involved in widespread and increasing mosquito abatement programs are the subject of many inquiries received by this Service. A 2-year study of salt-marsh spraying with DDT was made by research personnel at the Brigantine Wildlife Refuge near Atlantic City, N. J. Results indicated that dosages now in use may be harmful to fish, blue crabs, fiddler crabs, and other invertebrates that are important foods for fish and ducks, rails, and other birds. The only commercial species studied, the blue crab, was temporarily eliminated or greatly reduced by dosages of 1 to 1.5 pounds of DDT per acre. At lower concentrations less mortality resulted. The work indicates the need for moderation and supervision of such control programs.

Studies also were made at Princeton, N. J., on the effects on wildlife of heavy application of DDT now being used for control of the beetles carrying Dutch elm disease. Tests resulted in relatively heavy mortality to birds and indicated modifications of technique by which immediate losses can be reduced. Long-term effects of DDT residue cannot yet be measured.

Nine biologists of the section of Wildlife Investigations on Public Lands were active on 27 projects of Southern, Midwestern, and Western public lands. These investigations center on difficult problems, long-range in nature, with solutions widely applicable in public-land management. Division of projects is as follows: 8 concern the ecology of deer—their place in forestry, range management, and as a game species; 14 involve study of damage to forest and range by small animals—deer mice, snowshoe hares, porcupines, and pocket gophers; and 3 pertain to game-bird ecology and management. Regular periodic reports make results available to public agencies.

The section of Wild Fur Animal Investigations, in cooperation with the States, assembles and publishes each year Wildlife Leaflet No. 315, Annual Fur Catch of the United States, and No. 326, Abstract of Fur Laws. Further information has been obtained on the size of the fur-seal herd and the number of seals migrating to Japanese waters, and cooperative investigations of management methods for fur animals in Louisiana and other Southern States are progressing. With the exception of muskrats, most fur-animal populations are increasing.

RIVER BASIN DEVELOPMENT AND WILDLIFE NEEDS

During 1951 the Office of River Basin Studies completed and released approximately 180 reports on development projects planned by other Federal agencies or private interests under Federal permit. Of this total about 84 were on Corps of Engineer projects, 37 on Bureau of Reclamation projects, 8 on Soil Conservation Service projects, 50 on private water-power projects licensed by the Federal Power Commission, and one was prepared jointly with the Bureau of Reclamation on a special area related to a project operated by that agency. These reports contain recommendations which, if adopted, will result in the prevention of considerable damage to fish and wildlife and the improvement of these resources in many cases.

A couple of the projects are worth particular mention. One is the joint report issued by the Fish and Wildlife Service and the Bureau of Reclamation on a portion of the Central Valley project in California. This report, prepared in cooperation with the California Division of Fish and Game, marked the conclusion of a comprehensive study of the relationship of waterfowl in the lower San Joaquin Valley to the Grasslands and the Central Valley project. Purchase of floodwater rights to 98,234 acres of the grasslands on the west side of the San Joaquin River by the Federal Government for Central Valley project purposes threatens a significant portion of the waterfowl habitat in the lower valley. In order to prevent much of this loss, the report recommended that, as an added feature of the project, there be developed (1) a water supply for supplementing rights on the existing Los Banos State Waterfowl Refuge, (2) a proposed enlargement of that refuge, and (3) a proposed Federal waterfowl-management area. It further recommended that return flows and underground water be developed to perpetuate the private grassland area as waterfowl habitat. This would be accomplished by the land owners through an organized water-use district.

Another project of particular concern to the Service is the Bureau of Reclamation Project for River Control Operations on the Colorado River between Needles and Topock, in California and Arizona. Channel dredging and straightening operations together with levee construction have closed off secondary channels supplying water to extensive marsh areas of the Havasu Lake National Wildlife Refuge. This refuge is considered essential to the maintenance of waterfowl populations within the Lower Colorado River Valley. The Service conducted an investigation of this project and released its report in July 1950. On the basis of its recommendations, the Department has approved plans for the restoration of damaged portions of the refuge and the construction of additional levees and other facilities to improve the value of the refuge to water fowl.

The wildlife habitat development program in the Missouri River Basin advanced during the year. Work was begun on developments at Heart Butte Reservoir in North Dakota, Shadehill Reservoir in South Dakota, and Bonny Reservoir in Colorado. Work was continued on previously initiated developments at Angostura Reservoir in South Dakota, Medicine Creek Reservoir in Nebraska, and Enders Reservoir in Nebraska. These are located on lands adjacent to Federal reservoirs and are used to replace wildlife habitat destroyed by the reservoirs or to improve the conditions for wildlife.

Work was initiated on two new basin-wide surveys. The first is concerned with the Arkansas-Red-White River Basins and the second with a similar survey of the New York-New England area. The President requested the appropriate Federal agencies to conduct these surveys in cooperation with the area States to develop comprehensive plans for multiple-purpose water-resources development.

A new section of Drainage Liaison was created in the Office of River Basin Studies on July 1, 1950, to work with all public agencies having land-drainage programs which may affect wildlife. Its main objectives are to (1) delineate the wet areas of the United States; (2) classify these areas as wildlife habitat; and (3) evaluate the lands for wildlife use. Upon completion this will provide an inventory of remaining wet lands in the United States with their value to wildlife.

Investigations are already under way in North Dakota, South Dakota, and Minnesota to determine the relative value of various types of "potholes" and other small water areas for wildlife. The potholes region of these States is used extensively by waterfowl as a breeding ground. The drainage of these potholes, implemented by Government subsidies, has been severely criticized by wildlife conservationists.

life and agricultural values, (3) the damage that will accrue to wild-

A cooperative field study has been inaugurated jointly with the Soil Conservation Service in the Gulf Coast Soil Conservation District in Louisiana to determine (1) the type of wet lands, (2) their wildlife from drainage for agricultural purposes, and (4) possible development and improvement of these lands to produce a wildlife crop. This section of Louisiana is highly important for wintering waterfowl as well as for muskrats.

ADMINISTRATION OF FEDERAL STATUTES FOR PROTECTION OF FISH AND WILDLIFE

During the fiscal year 1951, 21 new United States game-management agents were selected for appointment from United States Civil Service registers. Most of these men saw action in World War II and all but one had been employed by State fish and game departments for some years before joining the Fish and Wildlife Service. At the present time the field force numbers 100 men.

Increased manpower permitted the temporary assignment of additional agents to areas in immediate need of attention. In the States in which migratory birds threatened agricultural crops, Service personnel utilized aircraft, pyrotechnics, electric beacons, and other devices to aid in the dispersal and, where necessary, issued permits to landowners to herd, disperse, or kill depredating birds.

Special enforcement crews were temporarily assigned to several States in which serious violations of the Federal conservation laws and regulations were occurring. The crews utilized the services of game-management agent-pilots, two-way radio communication, and other special equipment. In most instances radios were tied into State fish and game department networks.

Organized groups of game-law violators who are engaged in illegal traffic in game for profit use automobiles, trucks, fast boats, and in some instances aircraft. To detect and apprehend these market hunters, the Service has recently developed an efficient air-ground communication system whereby agent-pilots keep in constant touch with ground crews and direct them, with a minimum of delay, to individuals who are observed to be in violation. Areas formerly notorious for game-law violations are now being rigidly patrolled.

Eight agents were temporarily assigned to assist in the enforcement of commercial fishing regulations in Alaska. During the spring several Alaska agents were detailed to work on the Pacific flyway.

The program was intensified on the Pacific coast to enforce both the sockeye salmon and halibut regulations. Service personnel equipped with a twin-engine flying boat, as well as seagoing vessels, inspected fishing craft and apprehended a number of individuals found in violation. This particular program, as is true of most engaged in by the Service, was coordinated with State enforcement activities.

Some of the outstanding violations during the year were the following: The manager of a west coast fish company who was charged with receiving and illegally possessing over 19,000 pounds of halibut entered a plea of guilty in Federal court at Seattle, Wash., on November 22, 1950, and was fined $1,000. The seized fish were sold at auction for $4,387.

Twelve prosecutions for the taking of sockeye salmon during the closed season contrary to the regulations of the International Pacific Salmon Fisheries Commission and the State of Washington were concluded in State court at Friday Harbor, Wash., during August 1950, by pleas of guilty. Fines and costs totaling $1,124 were imposed.

For using an airplane to circle and spot big game in the open season contrary to regulations under the Alaska Game law, an offender was fined $300. The plane was seized, libel proceedings filed, and the court ordered the plane to be forfeited to the Government.

Two persons who possessed beaver skins contrary to the game laws of Washington and who offered to sell them to Federal agents were prosecuted in a Washington State court on March 12, 1951, entered not guilty pleas, and were adjudged guilty on each of two counts. Each defendant was fined $1,000 and also given a 90-day jail sentence. The jail sentence and half of the fine were suspended in each case.

COOPERATIVE CONTROL OF PREDATORS AND RODENTS

Several forms of wild animals are at times so destructive to resources essential for man's economic welfare that their local control is necessary. Selective methods for their removal have been developed by the Service as a result of extensive research and long experience in managing wildlife populations. Although facilities were not available in 1951 for expanding such control operations, results from the work were further improved through greater efficiency of methods and the teaching of these techniques to the public by means of demonstrations, extension-type technical-guidance projects, and Service-supervised programs.

A new rat and mouse poison, known as warfarin, was one of the most spectacular contributions to improved control methods during the past year. This chemical is less hazardous to human beings and domestic animals than most other commonly used rodenticides and is equal or superior to them from the standpoint of effectiveness. Its introduction and widespread use were accomplished through prompt and effective cooperation of county agricultural agents, newspaper and magazine publicity, and issuance of a Service leaflet which describes methods for proper application. The leaflet was widely distributed throughout the United States and to many foreign countries in response to thousands of inquiries. As a result of this prompt conversion of scientific knowledge into practical information, unusually rapid progress was made in introducing the chemical. It now promises to be an effective means for materially reducing tremendous losses caused by rats and mice to foods and feeds. Technical aid was also given to manufacturers of warfarin rodent bait formulations. In this field the work was closely integrated with that of the Department of Agriculture, which enforces compounding and labeling requirements for rodenticides. Through unified effort of the two Government agencies, it was possible to aid manufacturers in rapidly placing large quantities of effective products on the market.

Further progress was made during the year in attaining greater selectivity of methods for predator control. Investigations in Colorado, Wyoming, and Idaho resulted in improved techniques for controlling coyotes by means of Compound 1080 without danger to valuable fur animals. In practically all cases it proved unnecessary to carry control operations directly into the principal habitats of fur animals. For example: Colorado statistics showed that 97.6 percent of the commercial fur catch was made in relatively small areas which comprise not more than 19.7 percent of the land area within the State. Coyotes frequenting many of these localities were removed by placing lethal stations on portions of their range in adjoining areas where fur bearing animals were not present.

A number of valuable game herds, particularly antelope, have been saved from heavy losses by improved use of 1080 to reduce predation. Investigations of the Arizona Game and Fish Commission revealed that coyote-control programs resulted in antelope fawn crops as great as 96 percent (the highest ever recorded in the State) as contrasted with survivals as low as 21 percent in areas where depredation was not controlled. Comparable benefits from predator control are reported by game managers and sportsmen with respct to big-game animals in several other Western States.

The outstanding accomplishments in conserving game are matched by even more spectacular results in the protection of domestic livestock. Before the use of modern methods of predator control it was generally accepted that sheepmen of the western ranges would sustain sheep and lamb losses of from 5 to 15 percent. During the past year members of sheep and cattle associations have stated that depredations are at an all-time low; many livestock raisers reported no losses. Direct savings of meat and wool can be conservatively estimated, under current price levels, at over 40 million dollars a year. There have also been indirect benefits through a decided decrease in the amount of manpower required to guard and handle the livestock, and through proper use of the range by animals that can be left free to spread out and graze. The relief from predator pressure has, for the first time, permitted extensive adoption of range sheep management under fence rather than under the usual herding system. Results have also been particularly gratifying to cattle raisers in the Sandhills section of Nebraska. In this area a single 1080 station accounted for 28 coyotes within a 5-week period.

The control of wolves and coyotes on certain game and reindeer ranges in Alaska was continued. As a result, the Nelchina herd of caribou has shown a decided increase in numbers. Indian owners of reindeer report similar benefits from the prompt and effective control of wolves by airplane hunters of the Service. Special predator-control methods, often time-consuming, are necessary in order to guard against damage to valuable fur resources in the area. Although little or no livestock aside from reindeer is jeopardized in Alaska, conservation of game resources has a more direct economic bearing than in the States. Many natives and other residents are dependent upon game for their existence, and hunting is also one of the few forms of recreation available to Armed Services personnel in that Territory.

Since facilities were not available for direct participation on the scale requested by the public, the Service has given more attention to educational extension programs in control methods for certain species, particularly in the eastern United States. For example, a rat-control conference was held in Baltimore in October 1950 in cooperation with city, county, and State officials. Key men from communities and organizations in 21 States participated and were thus better prepared to conduct rat-control programs in their own communities. Representatives of the Service participated directly in local demonstrations and schools in many communities. Methods for controlling animal pests in Utah and Idaho were shown in cooperation with the Union Pacific Railroad, which furnished a demonstration car for this purpose. Similar educational exhibits were displayed at a number of county and State fairs, and at conventions of trade associations.

Recognition of the Service as an authority in mammal-control techniques continued to attract increased international attention, and inquiries for technical information have been answered from many areas outside the United States, including Costa Rica, Guam, Puerto Rico, France, Germany, Denmark, Sweden, Israel, Burma, the Philippines, and India. A short course on rodent control was also given to a conference of agricultural missionaries, held in Washington, D. C. Representatives of the Service made short visits to Saskatchewan, Canada, and to Sonora and Chihuahua, Mexico, to demonstrate predator-control methods at the request of the respective governments. The Mexican activity was a continuation of previously conducted work arranged through the Pan American Sanitary Bureau as an aid in guarding against rabies epidemics along the international boundary.

Operations for the suppression of rabies among wild animals within the United States were carried out in San Diego County, Calif., and in local outbreaks in Arkansas, east Texas, Georgia, Alabama, North Dakota, and Montana. Most of these related to rabies among foxes, but coyotes were also involved in the San Diego County suppression program, and skunks were locally controlled in North Dakota and Montana.

It became evident early in 1951 that large amounts of natural resources, particularly range forage, were being lost through depredations by rodents on public and Indian lands. Increased operating costs during the past 5 years have made it necessary to reduce the work on public lands where cooperative funds to do the work were not generally available. When officials of the Indian Service, the Forest Service, and the Bureau of Land Management became acutely conscious of the large amount of range forage that was being diverted from the production of meat and wool through the ravages of ground squirrels, gophers, and prairie dogs, the three agencies joined the Fish and Wildlife Service in a quick survey of the extent of such damage. The results show that some 19 million acres of public and Indian lands require rodent control to conserve properly range and forest resources. The study indicates that 250,000 head of additional cattle could be grazed on public ranges if destructive rodents were eliminated.

The recorded catch of predatory animals included 60,445 coyotes, 1,378 wolves, 13,343 bobcats and lynxes, 733 stock-killing bears, and 229 mountain lions. In rodent-control operations 10,995,464 acres of land were treated for the elimination of prairie dogs, ground squirrels, pocket gophers, jack rabbits, field mice, cotton rats, kangaroo rats, porcupines, woodchucks, and moles. In addtion 563,300 premises were treated in cooperative campaigns for the control of house rats. Special equipment and supplies used in predator and rodent control, and 342,415 pounds of rodent bait were distributed to cooperators throughout the country by the supply depot at Pocatello, Idaho.

THE NATIONAL WILDLIFE REFUGE PROGRAM

The importance of the national wildlife refuge system as a major factor in safeguarding an adequate breeding stock of migratory waterfowl and certain big-game animals is constantly challenged by demands to use these lands for other purposes.

Requests for use of refuge lands for national defense, while not so extensive as during World War II, have encompassed many of the same needs. Airfields, gunnery ranges, and bombing targets have been located on refuge lands, particularly in the West, where extensive Federal ownership precludes the need for additional purchase. This Service has approved requests, particularly for gunnery ranges, where there is reasonable assurance that wildlife populations will be undisturbed and undamaged, where satisfactory arrangements are made for fire protection, and finally, where relinquishment of such use is specified.

Military use of lands has been opposed when complete exclusion of refuge personnel is required for periods of several days. The inability to maintain water-control structures, patrol against trespass, guard against fire, and control predators can offset refuge gains of several years. The interruption of research may nullify studies undertaken over several seasons.

Another threat to existing refuges is the increasing demand for public shooting grounds. Protection, coupled with other forms of management which increase food and cover and otherwise improve environment, brings about a growing concentration of birds on the refuges. This naturally results in pressure to open refuges for public hunting. Where areas were large enough and the supply of birds was considered sufficient to permit hunting, portions of 17 refuges were opened.

Demands for public hunting have resulted in the evolution of a more flexible type of project, namely, the waterfowl management-refuge area, now being used with such success in Missouri, California, Wisconsin, and other States. Under this type of project, development and operation are carried out jointly by the State and the Federal Government. The State manages the public shooting portion and the Service the refuge. Projects of this sort encourage the States to participate in waterfowl management.

On the Horicon National Wildlife Refuge in Wisconsin, the 21,500 acres in Federal ownership have been matched by a comparable purchase by the State. The same is true of the Mingo National Wildlife Refuge in Missouri, and of the new Stillwater Wildlife Management Area in Nevada. In California, under the Lea Act, a joint endeavor of the Service and the State of California, State acquisitions have augmented the Federal refuges and in most instances are not contiguous.

Amendment of the Migratory Bird Hunting Stamp Act in 1949, increasing the cost of the "duck stamp" from $1 to $2, has provided additional funds for refuge acquisition, development, and operations. These funds were available for the first time during the 1951 fiscal year. This increased income has permitted the resumption or undertaking of important engineering developments which had been previously deferred.

On the 39,000-acre Necedah National Wildlife Refuge, in central Wisconsin, the Sprague-Mather pool was completed which will create a 3,000-acre impoundment to furnish a summer water supply for the Rynearson pools. The restoration of the 21,500-acre Mingo National Wildlife Refuge is southeastern Missouri was begun this year after having been deferred for some time. Water controls, including the gate structure and spillway, are being built. With the completion of the levees in 1952, restoration of this famous marsh will be accomplished. Fresh-water pools, in a normally salt-water environment, have been completed on the 6,500-acre Parker River National Wildlife Refuge in Massachusetts and are under construction on the 7,000-acre Willapa National Wildlife Refuge in Washington. The building of a water-control structure on the 15,000-acre Rice Lake National Wildlife Refuge in eastern Minnesota has now been started—a project which had been postponed for several years. It will create an additional marsh area.

The cooperative development with the State of Stillwater wildlife management area in western Nevada will provide marshes and ponds of nearly 30,000 acres. Approximately 10,000 acres are managed as a Federal refuge. The water impoundment program, now under way, includes the construction of canals, ditches, and water-control structures. Another important restoration on which development has continued is the 21,500-acre Horicon National Wildlife Refuge in central Wisconsin. The dam and controls are expected to be completed in 1952 and permit regulation of water levels. The dragline work on the 142,000-acre Sabine National Wildlife Refuge in Louisiana has continued for some time, but during the past year this work was accelerated in order that the 24,000-acre fresh-water pool may be pushed to completion. Work on the control structure is under way.

Control gates have been replaced at a number of points on the 65,000-acre Bear River Migratory Bird Refuge in Utah. These concrete structures are replacing wooden gates built as early as 1932. Water from the Bear River is distributed by canals, which lead off across the marshes, delivering the limited supply of water to the higher ground and to the various marsh areas on the refuge. Nearly 40 miles of earthen dikes with gravel beach lines, most of them topped with roadways, divide the refuge into five impoundments, each comprising about 5,000 acres. The dikes exclude the salty waters of the lake and impound fresh water from the river. They have also brought about the drying of shallow waters and mud flats beyond the dikes—areas which were centers for outbreaks of botulism. Similar problems of fresh-water conservation have been developed on the 31,000-acre Salt Plains National Wildlife Refuge in Oklahoma by constructing a check dam to divert Salt Creek.

The 3-year construction program on the 24,000-acre Lower Klamath National Wildlife Refuge on the Oregon-California line has been aided by duck-stamp funds and is ahead of schedule. Dikes, water controls, and ditches for handling excess waters are being built. In southern California dragline work continues on the 39,000-acre Salton Sea National Wildlife Refuge. Similar work is under way on the 24,000-acre Bitter Lakes National Wildlife Refuge in New Mexico, and the 39,000-acre Laguna Atascosa National Wildlife Refuge in southern Texas. The construction or rebuilding of channels is under way on the 9,000-acre Reelfoot National Wildlife Refuge in Tennessee, and the 7,000-acre Squaw Creek National Wildlife Refuge in Missouri.

Water control on the 162,000-acre Malheur National Wildlife Refuge in southeastern Oregon, in both the Blitzen Valley and the "Double-O" unit, will provide an improved area for the trumpeter swans which were established here by transferring young birds from the Red Rock Lakes Migratory Bird Refuge in Montana. A water control and dikes were constructed on the 15,500-acre Bowdoin National Wildlife Refuge to create a new unit. Work on the 58,000-acre Lower Souris National Wildlife Refuge, the 23,000-acre Long Lake National Wildlife Refuge, and on several easement refuges in North Dakota was done to repair damage from the 1950 flood in the Red River Valley and other parts of the State. Similar damage was repaired on the 21,500-acre Sand Lake National Wildlife Refuge in South Dakota and on the 61,000-acre Mud Lake National Wildlife Refuge in Minnesota.

On the 94,000-acre Seney National Wildlife Refuge, located on the Upper Peninsula of Michigan, repairs were made to dikes and wooden water-control structures were replaced. Another unit is being developed on the 14,000-acre Bombay Hook National Wildlife Refuge in Delaware, while fresh-water pools are being developed by diking on the 9,000-acre Chincoteague National Wildlife Refuge on the Eastern Shore of Virginia and Maryland.

Biological development on existing and new refuges has been aided by duck-stamp funds, and by new techniques in control of pest plants and undesirable animals. Some progress is being made in studies of wildlife diseases, particularly botulism, while fowl cholera and lead poisoning continue to cause heavy annual losses. An unusual mortality occurred among the sea otter on the Aleutian Islands National Wildlife Refuge in Alaska after several years of very encouraging increases.

Herds of buffalo, elk, deer, and long-horned cattle continued in healthy condition on the four fenced big-game preserves. The number of buffalo on these preserves constitutes about one-fourth of the total United States population. Owing to drought condition on the National Bison Range in Montana, disposition of 166 of these animals was completed during the fall of 1950. At the same time, 445 mule deer were live-trapped and donated to the Flathead Indians for use in restocking their lands. There are nearly 400 long-horned catttle on the Wichita Mountains Wildlife Refuge in Oklahoma and on the Fort Niobrara National Wildlife Refuge in Nebraska.

LAND ACQUISITION

The acquisition of two important additions to the national migratory waterfowl refuge program was initiated during the year. In Florida an agreement was reached with the Central and Southern Florida Flood Control District whereby there would be made available to the Fish and Wildlife Service approximately 100,000 acres of land in water conservation area No. 1, in Palm Beach County. This area, comprised of ponds, sloughs, and marshes with interspersed hammocks, will be an important addition to the wintering areas for waterfowl.

Under the California wildlife-management program, a contract has been entered into for the purchase of 2,550 acres of land in the San Joaquin Valley. This tract, located in Merced County, will provide a feeding area for migratory waterfowl and will aid in the reduction of crop depredation on nearby agricultural lands. Approximately 700 acres of the total area have been leveled and placed in agricultural production to supplement the food supply for waterfowl. All or part of the area will be open to public hunting when the size of the waterfowl population warrants such action.

Negotiations are under way with the Corps of Engineers, Department of the Army, to make available for the management of wildlife, both by the several States and by the Fish and Wildlife Service, areas of land and water acquired by the Department of the Army for flood control or navigation purposes. The most important areas presently being considered are the Harlan County Reservoir in Nebraska, the Enid Reservoir in Mississippi, and the lands along the Mississippi River in the States of Minnesota, Wisconsin, Missouri, Iowa, and Illinois.

The status of lands acquired and in process of acquisition for wildlife conservation purposes is shown in table No. 4.

Table 4.—***Acreage acquired or in process of acquisition for wildlife conservation purposes under the Migratory Bird Conservation Act by exchange and other acts of Congress, July 1, 1950–May 31, 1951***

State	Refuge	Acquired other than by purchase	Purchased	Total acquired	Pending title conveyance
Alaska	Lake Hood	17		17	
Arizona	Cabeza Prieta				1
Do	Kofa		1	1	
California	Merced				2, 550
Florida	Chassahowitzka		2, 786	2, 786	7, 103
Do	Loxahatches				560
Georgia	Blackbeard Island	959		959	
Do	Piedmont	2, 083		2, 083	242
Idaho	Deer Flat				74
Iowa	Union Slough				34
Do	Upper Mississippi		2	2	
Kentucky	Kentucky Woodlands	23	99	122	86
Maine	Moosehorn				198
Maryland	Blackwater				417
Minnesota	Rice Lake				46
Do	Tamarac		2	2	
Do	Upper Mississippi				57
Mississippi	Noxubee				1, 216
Missouri	Mingo		818	818	90
Do	Swan Lake				88
Nebraska	Crescent Lake		2, 560	2, 560	
Do	Valentine	120	984	1, 104	
New Jersey	Brigantine				795
New Mexico	Bosque del Apache		963	963	
New York	Wertheim		11	11	8
North Dakota	Lake Zahl		640	640	745
Do	Lower Souris				2
Do	Upper Souris		5	5	
Oklahoma	Salt Plains		549	549	80
Oregon	Malheur				4, 298
South Carolina	Carolina Sandhills				50
Vermont	Missisquoi		135	135	
Virginia	Chincoteague				151
Washington	Lenore Lake	55		55	
Do	Little Pend Oreille	119		119	1, 042
Do	Turnbull				1, 192
Do	Willapa				228
Wisconsin	Horicon	107	947	1, 054	133
Do	Upper Mississippi				133
Total		3, 483	10, 502	13, 985	21, 619

National Park Service

Arthur E. Demaray, Director

IN THE YEAR JUST ENDED more persons than ever before have sought the enjoyment—the re-creation of body and mind and spirit—which is offered by the most striking examples of the American natural scene and by those acres of land and those structures which are most significant in the human history of our United States. We who are charged with protecting these possessions and making them serve the desires and the needs of Americans in the best and most satisfying fashion carry in our hearts the deep conviction that their service is one of profound value; that, in times when our fundamental beliefs are challenged and threats to the peace of the world hang over us, they help to strengthen our loyalty to and love of our country and our will to defend it courageously and unselfishly. Upon us in the National Park Service rests the obligation on the one hand to defend them against destructive encroachment and on the other to seek constantly for ways in which to make them serve their fundamental purposes better.

The National Park System is only a part—but a tremendously important part—of this country's provision of places and facilities in which its people may make pleasant and beneficial use of their leisure time. An important corollary responsibility of the National Park Service is to act, to the extent that it can, as a sort of catalyst in bringing about better planned and better distributed systems of parks and recreational areas throughout the United States. Its responsibilities in this respect have grown steadily in extent and importance during the past two decades; it will continue to meet them as best it can, both to provide for genuine needs and in the interest of greater economy in meeting them.

In the National Park Service we have turned our attention particularly to the way in which the National Park System can best serve those who wear the uniform of the Armed Forces of the United States, many thousands of whom have had to be separated from homes and families and the normal routines of business and social life.

Many of them will have opportunities that would not otherwise have come to them to visit the great places of nature and of history that have been set aside for their enjoyment and, through acquaintance with them, perhaps to acquire a greater love of and admiration for the country they are called upon to defend.

As a helpful first step, Secretary Chapman approved a recommendation of the Director that, as during World War II, all fees be remitted for men and women in uniform. Further, through the establishment of an effective liaison with representatives of Army, Navy, and Air Force here in Washington, and by supplying them with printed material, the opportunities offered by the parks have been brought to the attention of all commands and field stations, with a warm invitation to make use of them. At the same time, our superintendents have been instructed to study carefully all possibilities for individual or group use that might be made of the areas they administer by men and women in uniform.

In the year just ended, there have been a number of significant developments within the System, of which the most important was the transfer of administrative responsibility for Independence Hall, with its Liberty Bell, and its associated structures to the National Park Service. That is a responsibility which the Service has accepted with a determination to accord these priceless buildings the utmost in protection and to encourage, in every way possible, public understanding and use of them.

Events of the year particularly worth noting include the highly satisfactory revision of concessions policy approved by the Department, and agreement on standard concession contract terms; steady progress in acquiring key inholdings; the passage of legislation consolidating most of Jackson Hole National Monument with Grand Teton National Park; final establishment of the George Washington Carver and Castle Clinton National Monuments; acquisition of all remaining private lands within Everglades National Park and much improved law enforcement there; completion of the reorganization of the four regional offices of the Service; and stricter control of water-control investigations in the parks.

INDEPENDENCE SQUARE GROUP

The National Park Service, on January 2, 1951, assumed the administration, for the Department of the Interior, of the most important group of historic structures in the United States. These are Independence Hall, Congress Hall, the old City Hall, and associated structures in Philadelphia's Independence Square. On that day, Secretary Chapman received the keys of Independence Hall from Mayor

Bernard Samuel of Philadelphia, to mark the formal transfer of the buildings from city to Federal administration. These structures, birthplace of the Declaration of Independence and the Constitution of the United States, and the seat of government during much of the American Revolution and in the period 1790–1800, will remain the property of the city of Philadelphia. In every other way the responsibilities of the Service are identical with those borne with respect to the federally owned areas it administers.

In his acceptance speech, Secretary Chapman called for a rededication to the principles of American freedom symbolized by the Independence Hall group of buildings.

As quickly as possible after assuming administrative authority and responsibility there, the Service launched a series of measures designed to provide effective administration and maintenance, as well as to further the larger Independence National Historical Park project. A permanent park staff, headed by a superintendent, and including a number of former custodial and administrative employees of the city of Philadelphia, was established. This included both interpretive and research personnel. Important renovation work—painting, replacement of worn timbers, and the repointing of exterior brickwork—was launched, and much of it has been accomplished. Within Independence Hall an urgently needed program of restoring historic paintings was carried out. To acquaint the public more thoroughly both with the significant history of the site and with the national historical park project required an active program of public interpretation. This included such items as specially conducted tours for school groups and organized parties, collaboration with the Philadelphia public schools on a series of educational broadcasts, and the opening of a public information center, where exhibits explain the historic structures and the events which have taken place in them, and where literature of many kinds is available.

The acquisition of historic properties within the projected Federal area moved forward with the filing of a "declaration of taking" on 28 properties. Another declaration is pending on 10 additional parcels; options have been obtained on 11 others. Secretary Chapman has also accepted a tract of land at the Benjamin Franklin homesite, which was donoted to the project by the city of Philadelphia. Cooperative agreements, designed to protect two extremely important historic structures—Christ Church and Carpenters' Hall—against undesirable changes in appearance, and which also permit the Service to include them in its guide and interpretive program, were concluded with the Vestry of Christ Church and with The Carpenters' Co., owners of these properties.

CONCESSIONS

As was stated in last year's report, the Department undertook a further study of its concessions policy, since it had become apparent that little progress was to be expected under the policy enunciated in 1948 (by former Secretary Krug). Before the end of the year, Secretary Chapman had approved certain basic principles which, in most respects, supported procedures which the National Park Service had developed through three decades. The revised statement of policy, embodying these principles, was issued last October after numerous conferences with representatives of the concessioners and after careful consideration of all comments and recommendations received. The policy is generally acceptable to a majority of the concessioners, as is the standard language for concession contracts based upon it. This standard language, approved in March by Secretary Chapman, provides the basis for concession contract negotiations, subject to such modifications as any individual case may require.

Relatively minor concessions are to be covered by permit rather than contract. After regional directors and field offices had been given a full opportunity to review proposed standard provisions for such permits, these were distributed to the field in the form of a general memorandum.

The important features of the present statement of policy were summarized briefly last year. One of the major provisions concerns franchise fees. As a rule, these will consist of a reasonable flat charge, for ground rent, plus an additional amount based on percentages of gross revenue. There is a proviso, however, that no fees will be required (except for ground rent) unless there are current net profits from which to pay them. In addition, the policy recognizes that in certain situations some other basis than percentage of gross revenue might be justified; it allows the necessary degree of flexibility to permit this.

Concessioners' Rates and OPS Regulations

The impact of the war in Korea has gradually made itself felt in the operating activities of virtually all concessioners. This impact became most acute with the issuance by the Office of Price Stabilization, on January 26, 1951, of general ceiling price regulations. These raised several problems as to the rates concessioners may charge. Service approval of rates has been based on the principle that prices should be such as to permit a fair profit; OPS regulations, on the other hand, froze prices completely or set up formulae permitting fluctuating prices, depending on certain costs. This difference in basic procedure raised many difficult questions. To clear them up, the Department has asked that National Park concessioners be exempt from the OPS regulations. The matter is now under consideration in the Office of Price Stabilization.

Operation of Recreational Facilities in D. C.

A 5-year contract satisfactory to the Department has been negotiated by the Service with the S. G. Loeffler Co. covering the operation of golf courses and related facilities in the National Capital Parks. The contract would permit the District of Columbia Recreation Board to purchase the Loeffler property, if funds should be provided to it for that purpose, before the end of the first 2 years of the contract period, and to take over operation of the golf courses. A resolution of the Recreation Board expresses appreciation for the cooperation of the Department of the Interior and for the sincere efforts of the Service to include in the contract provisions recommended by the Board.

Isle Royale Transportation

The problem of assuring adequate and safe transportation across Lake Superior to Isle Royale National Park is still unsolved. However, the situation is at least slightly improved. Arrangements were made with National Park Concessions, Inc., operating accommodations in the park, also to transport park visitors on the Service's vessel, *Ranger II.* This boat, with a Coast Guard limitation of 16 paid passengers, will operate during the season between Houghton and Isle Royale, making 2 round trips each week. This arrangement has met with warm approval in the communities of the Upper Peninsula.

In Everglades National Park

Occupying temporary structures, National Park Concessions also operated a snack bar and a gasoline service station at Coot Bay from late December to the end of April. These facilities filled a real need and were well received. During slightly more than 4 months of operation, 7,064 meals were served. Charter boats and skiffs, serving visitors seeking the excellent sport fishing, also worked out of Coot Bay under Service jurisdiction.

Glacier National Park Facilities

With its contract expiring on December 31, 1951, the Glacier Park Co. has stated that it is not interested in seeking a 20-year renewal. It proposes to continue operations on a year-to-year basis until such time as it is able to dispose of its facilities for a satisfactory amount to another concessioner. A subsidiary of the Great Northern Railway, the company has operated in Glacier almost since the establishment of the park more than 40 years ago. Its hotels, lodges, and chalets were provided primarily to promote railway travel. In the beginning, travelers by rail comprised almost the total patronage of the park. Of recent years, they have amounted to only about 2 percent of all visitors.

Audit of Concessioners' Annual Reports

Progress in clearing the heavy backlog of concessioners' annual reports was seriously slowed down by the Service's inability to hold fiscal auditors in the grades authorized for them, in the face of opportunities to move into higher grades in other Federal offices. Four were so transferred during the year and only one of the vacancies has been filled.

At the beginning of the fiscal year, 570 reports were on hand to be audited; 215 were audited in the 12-month period, during which 157 new reports were received. The net gain was thus only 58. However, the work performed resulted in recommendations by the auditors for the collection of additional fees, in a substantial amount. The total may, of course, be reduced in final settlement, since contracts call for an administrative determination on disputed items. It does, however, show an indication of additional revenue to be received in the future as the result of discontinuing irregular practices and maintaining better records. With very few exceptions, the concessioners audited maintained adequate records and only minor technical accounting differences were noted.

Increased Accommodations

Additional overnight accommodations, sufficient to care for a maximum of 715 persons, are available in various areas for the summer of 1951. Those added in Yosemite National Park will house 211 persons; those in Yellowstone, 164.

WATER-CONTROL PROJECTS AND THE PARKS

Order No. 2618, issued by Secretary Chapman, was a significant step in protecting national parks and monuments as well as established wilderness areas in national forests and national wildlife refuges against water-control investigations. This order prohibits any such investigations by Interior agencies in those several types of areas unless specifically authorized by the Congress or given prior written approval by the Secretary.

Though Secretary Chapman decided to recommend the construction of the Echo Park and Split Mountain Dams as parts of the development of the waters of the Upper Colorado, the opposition of many conservation organizations throughout the country continues. With the concurrence of the Secretary, the Service has continued to supply factual information regarding the proposed dams and dam sites to all who requested it and regardless of their attitude toward the dams. It has similarly supplied photographs, or arranged for them to be supplied, in response to legitimate requests, and upon the same impartial basis. Several groups of persons, representing organizations of standing, have visited the monument, and the Service has assisted them to see it satisfactorily but its representatives have sedulously avoided any attempts to rouse or strengthen opposition to the dams.

The decision of the House Committee on Interior and Insular Affairs to table legislation which would have authorized the Bridge Canyon Dam, until California and Arizona resolve their differences over allocation of Colorado River waters, defers indefinitely a project which would have backed Colorado River waters through the Grand Canyon National Monument and for some miles into Grand Canyon National Park. The status of the Glacier View Dam proposal of the Corps of Engineers, which would flood some 20,000 acres of Glacier National Park, and of the Mining City Dam proposal, also a Corps of Engineers project, which would affect Mammoth Cave National Park, remain about as reported a year ago. A representative of the Corps recently reported that several locks on the Kentucky River would be permanently closed. These included lock No. 6, which has already caused serious silting of the underground Echo River within Mammoth Cave; it is hoped that the Corps may be persuaded to leave it open and give the river a chance to cleanse the cave of silt.

Construction of the Lower Cumberland Dam and Reservoir on the Cumberland River, if authorized, would result in occasionally flooding part of Fort Donelson National Military Park, Tenn. It is believed, however, that ways can be devised to avert significant damage to park values.

DESIGN AND CONSTRUCTION

The master plan has been accepted for more than two decades as the basic planning document for development of an area in the National Park System. Yet the 1951 fiscal year was the first in which funds were appropriated specifically for master plan preparation.

Although nearly 300 new or revised drawings were submitted during the year, they are only the first step in bringing the master plans up to date after 10 years of chronic shortage of personnel. Approximately 1,000 drawings, and their supplementary development outlines, still require revision. Some areas administered by the Service still have no master plans. Yet such plans, constantly adjusted to meet current and expected trends of public use, offer the only economical and practical method of providing an adequate program for necessary expansion.

Communications

Adequate communications are the lifeline on which fire-fighting, rescue work, and ordinary administrative routine largely depend. Allotments totaling $427,269.50 were made during the year to buy and install FM radio communications equipment. This is being set up in Acadia, Big Bend, Everglades, Glacier, and Isle Royale National Parks and in Death Valley, Fort Sumter, Glacier Bay, Organ Pipe Cactus, and Fort Jefferson National Monuments. FM radio communication has been specified by the FCC for the parks and must replace other systems by 1953.

In order to assure itself of satisfactory performance by radio equipment, the Service has had to establish its own radio laboratory. There, during the past year, it "type tested" 107 pieces of equipment submitted by manufacturers. Radio surveys were completed in 16 areas, and plans, system drawings, and bid specifications were prepared for 10.

Roads and Trails Under Defense Conditions

Though more than 5 years have passed since the end of World War II, and park visitors are still harassed by road deficiencies and other problems created by that conflict, the Service again finds itself handicapped by limitations arising out of the current period of defense planning and mobilization. The yearly allotment for these purposes is scheduled to be reduced to $1,500,000 or less, though there is a reconstruction backlog of $84,500,000. New work is estimated at $108,500,000 for either basic development in recently established areas or for elements necessary to expansion of existing facilities.

Parkways

As with many other Government activities during the past year, parkways became a part of the defense program, besides serving their usual recreational purpose. With the placing of emphasis on projects of a defense nature, the Baltimore-Washington Parkway became the major item of the program. This, considered a vital link in the defense network of the National Capital, was authorized by Congress in August 1950; and $3,000,000 of the $4,000,000 appropriated for parkways was programed for it. The remaining $1,000,000 was for work on the Blue Ridge Parkway, and for minor construction on the Natchez Trace and Suitland Parkways. In December, another $1,500, 000 of contract authorization was made available for the

Baltimore-Washington route. No funds were available for other authorized parkways.

During the year, 36 major road projects were either completed or under way on the parkways, in collaboration with the Bureau of Public Roads—15 on the Blue Ridge, 8 on the Natchez Trace, 2 on the George Washington, 1 on the Suitland, and 10 on the Baltimore-Washington. Major projects completed amounted to $3,632,851.63; work to cost $7,865,596 was under construction at the end of the year. Construction was also either completed or under way on about 160 projects directly supervised by the National Park Service, for roads, trails, buildings, and utilities along the parkways. Four maintenance areas—two each on the Blue Ridge and Natchez Trace Parkways—were also in the construction program. It included numerous public service features such as picnic areas, parking overlooks, comfort stations, trails, and a variety of other facilities.

It is estimated that it will require approximately $202,760,000 to complete the eight national parkways which Congress has authorized.

Physical Improvements

National Production Authority restrictions on use of building materials, increases in labor and materials costs, and reduced construction appropriations have seriously curtailed the building program of the Service. Great increases in numbers of visitors, virtual suspension of construction during the war and the years immediately following, and the deterioration of existing facilities have created an enormous backlog of urgently needed improvements throughout the System.

Concessioners are suffering from similar deficiencies and for very similar reasons. Construction of additional overnight accommodations is frowned upon because of the large amount of materials and equipment required.

In spite of these handicaps, certain projects show real progress. In Olympic National Park, work is proceeding rapidly on the road giving access to Hurricane Ridge, construction of the Service building there, and provision of utilities for its operation. Completed, the building will provide dining facilities and shelter to visitors, at a point reached by automobile road, where they may enjoy magnificent panoramas of the wild Olympic Range and of the Strait of Juan de Fuca.

During the year, Federal Hall Memorial (the old Sub-Tresaury Building on Wall Street), on the site once occupied by Federal Hall, the first seat of the Federal Government, was vacated by the Federal agencies which had been occupying it since before it was given national historic site status. Restoration of the rotunda on the first floor is under way as is establishment of the Zenger Memorial Room on the second floor, made possible by a donation of funds by the Zenger Memorial Associates.

Employee housing construction, so vital in many areas administered by the National Park Service, continues to lag seriously behind need. However, the past year has brought some improvement. Fiscal year 1951 funds were available for the construction of 16 residences, of which 11 were started by June 30. Six, financed from 1950 funds, were completed during the year. In addition, 23 older residences were improved by addition of a room or by conversion to year-round usability.

Storm Damage Was Heavy

Approximately $1,000,000 in damage was caused by floods, wind, and ice storms last winter in several of the areas administered by this Service. Particularly severe and costly damage was caused by floods in Yosemite, Sequoia, and Kings Canyon National Parks. Entire sections of roads were washed out, as were numerous bridges and other drainage structures. Great quantities of earth and rock were deposited on the roads as the result of slides. Water, sewer, and telephone systems, electricity, and other utilities were disrupted or severely damaged. Buildings and campgrounds were inundated and campground equipment washed away.

In the East, storms along the Great Lakes and Atlantic Coast did great damage to park facilities. In the South, unprecedented ice and snow storms, accompanied by low temperatures, damaged thousands of trees at Mammoth Cave, Shiloh, and Vicksburg and along the Blue Ridge and Natchez Trace Parkways.

Mississippi River Parkway Survey

Authorized by Congress to determine the feasibility of developing a parkway to follow generally the course of the Mississippi River from its source to its mouth, the 2-year Mississippi River Parkway study is nearly completed and work has been started on a report to Congress. The survey has been a joint undertaking of the National Park Service and the Bureau of Public Roads.

The project, for which $250,000 was made available to the two agencies, probably involved the longest road reconnaissance in history—a total of nearly 9,000 miles of existing highways and possible new road locations. Besides its collaboration with the Bureau of Public Roads in locating feasible routes for the roadway itself, the Service made special studies of historic sites, points of scenic or geologic interest, and existing or potential recreational areas, with a view to integrating them with the broad plan for the parkway.

As the survey nears completion, it appears to point to the desirability of recommending a new-type parkway within the Federal-aid

Highway System as a joint Federal-State undertaking, with the National Park Service acting as advisor. This might involve additional apportionments of Federal funds, above the usual Federal share, to aid in the preservation and development of scenic, historic, and recreational lands.

Certain existing State highways would be usable for the parkway, particularly in agricultural regions, if scenic easements or other forms of control were acquired to prevent roadside exploitation. Studies indicate that 40 percent of the parkway roadway should be built new.

HISTORY "WRITTEN ON THE LAND"

The National Park Service administers 100 historic and 19 prehistoric areas. In 71 of these it offers information, guide, and lecture service, made more effective, in most areas, by the use of varied graphic devices. To supplement the direct personal services provided to heighten visitors' understanding of America's history, there are 50 historical museums, ranging from 1-room temporary exhibits to full-scale installations, and a series of readable publications, both sales and free.

During the last travel year, the historic and prehistoric areas in the National Park System had 12,481,471 visitors, virtually all of whom were served by interpretive personnel or interpretive devices.

Preservation of Historic Sites and Structures

Preservation efforts have been devoted to a diverse group of historic sites and structures. Completion of the McLean House well house at Appomattox Courthouse National Historical Monument concluded one of the most important reconstruction programs in the Service's history. At Castle Clinton National Monument a general renovation program was started. The beginning of renovation at Federal Hall Memorial has been noted elsewhere. The walls of the library structure at Adams Mansion National Historic Site were stabilized and waterproofed and much other improvement work was performed there.

Excavation of the sixteenth-century earthwork at Fort Raleigh National Historic Site, N. C., was completed and the excavated earth was used to reconstruct the earthen parapet, thus restoring the ancient fort. Rehabilitation or repair to historic buildings was completed at Chalmette National Historical Park, La.; Salem Maritime National Historic Site, Mass.; Saratoga National Historical Park, N. Y.; Hopewell Village National Historic Site, Pa., Fort Laramie National Monument, Wyo., and Great Smoky Mountains National Park, N. C. and Tenn.

In the program of stabilizing prehistoric ruins, substantial progress was made under skilled direction at Aztec Ruins, Chaco Canyon, and Hovenweep National Monuments and Mesa Verde National Park.

Historical Research

Research by Service historians, and by students who pursued studies helpful to the Service, added materially to our historical knowledge. At Philadelphia, a project was set up for the summer months, with three students of architecture under the supervision of a University of Pennsylvania faculty member, to produce measured drawings of all buildings on which repair, restoration, or stabilization might be necessary within the Federal Government's portion of the Independence National Historical Park project. Studies regarding the furnishings of the historic buildings on Independence Square contributed much to the restored appearance of the structures as they were readied for the celebration of the one hundred and seventy-fifth anniversary of the Declaration of Independence.

Other research related to the Battle of Saratoga and the Schuyler House, now a part of Saratoga National Historical Park; both the Jamestown and the Yorktown portions of Colonial National Historical Park; Fort Necessity, Fort Jefferson, Fort Matanzas, Fort Frederica, Death Valley, Joshua Tree, and Aztec Ruins National Monuments; the Natchez Trace Parkway; Theodore Roosevelt National Memorial Park; and Hopewell Village and San Juan National Historic Sites. A research study entitled "Apache Prisoners at Fort Marion 1886–87" was completed at Castillo de San Marcos National Monument. A valuable study of the proposed Grand Portage National Historic Site was also completed.

The first archeological study undertaken by the Service in Hawaii National Park was begun there recently. Made possible by a small allotment of funds for the purpose, the study is being made by Henry E. P. Kekahuna and Theodore F. Kelsey, students of Hawaiian archeology, who have appointments as collaborators. They are working in the new Puna section of the park, which possesses a wealth of archeological values including temples of worship, ancient village sites, petroglyphs, etc.

Donations of Historical Materials

Last July, the gift by Dr. Ellison Orr, Waukon, Iowa, to Effigy Mounds National Monument of all his archeological books, papers, and relics, as well as books and papers on geology and geological specimens, was accepted by the regional director of Region Two. Following the death of Dr. Orr at the age of 93 last winter, these materials were brought to the monument. They represent a long lifetime of study, and will be particularly valuable in interpretation of the area to vistors.

Mrs. Eva Porter Doggett, daughter of Maj. Gen. Fitz-John Porter, added to previous donations by presenting a valuable and interesting group of original letters to the Manassas National Battlefield Park library.

Special Ceremonies

Historic Dorchester Heights, in South Boston, Mass., an important point in Washington's successful effort to force the British evacuation of Boston on March 17, 1776, was made a national historic site, and was dedicated with appropriate ceremonies on March 17, 1951. Title to the site remains with the city.

The Washington County Historical Society of Maryland presented the historic Dunkard Church site on the Battlefield of Antietam to the Service. Assistant Director Lee, who delivered the principal address at ceremonies at the site on May 30, also accepted the deed to the property. The Georgia Society of Colonial Dames dedicated and presented to the Service a tablet placed at the site where John Wesley first landed and offered prayer on American soil. The site lies within Fort Pulaski National Monument, Ga. Assistant Director Tolson delivered the address of acceptance at ceremonies held last fall.

Salvage Archeology in the River Basins

The program under which the Service contracts with State universities, State historical societies, and State museums for the excavation of important prehistoric sites in the impoundment areas of numerous dams, under construction or projected, has continued with gratifying results. For work in the Missouri River Basin, contracts were executed with Montana State University and the State Historical Society of North Dakota (Garrison Reservoir, N. Dak.); Nebraska State Historical Society, University of Kansas, and University of South Dakota (Fort Randall Reservoir, S. Dak.); University of Nebraska Graduate College (Harlan County Reservoir, Nebr.); University of Nebraska State Museum (Medicine Creek Reservation, Nebr.); and University of Wyoming (Keyhole Reservoir, Wyo.). For work elsewhere, contracts were entered into with the Museum of New Mexico and School of Administration (Chamita Reservoir, N. Mex.); University of Mississippi (Grenada Reservoir, Miss.); University of California (Farmington Reservoir and Death Valley National Monument, Calif.); University of Oklahoma (Eufaula Reservoir, Okla.); and University of Washington (McNary Reservoir, Wash.).

The cooperative archeological program of the Service with the Smithsonian Institution for work within reservoir areas was also continued with notable success. Scientific personnel of the institution carried out surveys and excavations in 18 in 7 States in the Missouri River Basin. Elsewhere it conducted archeological surveys in 15 in scattered locations throughout the United States. It also completed "digs" in 8 reservoir areas in New York, Texas, California, and Washington.

Seventy-fifth Anniversary of Little Big Horn Battle

With Lt. Gen. Albert C. Wedemeyer, commanding general of the Sixth Army, as speaker of the day, and with other distinguished military and naval officers and public officials among the guests, the seventy-fifth anniversary of the Battle of the Little Big Horn River, June 24–25, 1876, was observed at Custer Battlefield National Monument on June 25, 1951. With cooperation from the National Park Service, the program was sponsored by the American Legion, with other service and civic organizations of Hardin, Mont. Of particular interest was the presence of several Sioux Indians who had participated in the battle.

ANTIQUITIES ACT ENFORCEMENT

The period from July 1 to December 30, 1950, established an all-time peak for field research authorized by the Office of the Secretary in the form of Antiquities Act permits. During the calendar year 1950, 32 applications for field work permits were received; with favorable recommendations from the Smithsonian Institution, the National Park Service, and the heads of the land management bureaus concerned, 29 permits were issued. Of these, 21 were for archeological field work, 8 for paleontological. Work was authorized, in cooperation with the National Park Service, at Mesa Verde and Carlsbad Caverns National Parks, and at Arches, Badlands, Bandelier, Channel Islands, Canyon de Chelly, Death Valley, Dinosaur, Hovenweep, Natural Bridges, and Petrified Forest National Monuments.

The international situation and consequent defense preparations caused a sharp reduction in the number of applications received during the past 6 months. These totaled only 13 (11 in archeology, 2 in paleontology), all of which were granted, for work in 5 States and Alaska. Included within permit areas are Zion National Park and Canyon de Chelly, Capitol Reef, Death Valley, Navajo, and Petrified Forest National Monuments.

Violations of the terms of the Antiquities Act on Interior Department lands have been reported to the Bureau of Land Management for investigation and appropriate action, and to other responsible officials when violations occurred elsewhere on Federal lands. At the same time, there has been constant effort to educate the public as to the necessity of safeguarding the prehistoric treasures of the Federal lands against the unscientific and unskilled investigator and the pothunter, and the destruction caused by modern machinery on construction projects.

Pipeline and Archeology

An interesting example of the application of Antiquities Act requirements is found in connection with the El Paso Natural Gas Co.'s construction of a 451-mile pipeline system from northwest New Mexico, to near Topock, Ariz., on the Colorado River.

The company extended maximum cooperation, continuing the archeological survey across non-Federal lands as well as along feeder and distribution lines.

IN THE SCENIC-SCIENTIFIC AREAS

Healthy curiosity about the wildlife, the plants, and the geological phenomena of the nature areas administered by the National Park Service shows no sign of diminution among the millions of persons who visit and enjoy them. In fact it greatly outruns the ability of the Service to gratify it effectively. Though the interpretive programs in Wind Cave, Yosemite, and Mount McKinley National Parks and on the Blue Ridge Parkway have benefited considerably from the filling of new naturalist positions, the addition of such positions for the Service as a whole has not kept pace with need.

Direct personal service, whether to individuals or groups, is undoubtedly the most effective and most satisfying. When it cannot be provided fully, however, it becomes necessary to explore all possible substitutes. Therefore, the Service has continued its special attention to the expansion of self-guiding nature trails and other similar devices; to the improvement of visual materials; to in-service training; and to improved program planning to utilize the inadequate facilities and staffs to enlist the cooperation of visitors in using the parks with a minimum of wear and damage.

The areas in which these programs are carried on recorded more than 16,000,000 visitors last year and more than 12,000,000 interpretive contacts of various kinds. These cover a wide range—conducted trips, lectures, personal services at museums and other attended stations, and a variety of unattended devices.

Wildlife Control Activities

While a number of parks offer problems of controlling populations of animals which have increased beyond range capacity the most aggravated situation continues to be in Yellowstone where the northern elk herd last fall had an excess of about 7,000 animals. Hunting outside the park removed only 1,265 of these. Live-trapping and transplanting eliminated 406 more; 482 were slaughtered in the park by Service personnel. The total reduction of 2,300 animals, including the estimated winter kill, is only approximately equal to the annual increase; there was virtually no progress toward a real reduction. A program, looking to the reduction of the herd to approximately 5,000 animals over a period of 3 years, has been formulated and was approved at the spring meeting of the Absaroka Conservation Association.

At Yellowstone also, 258 antelope were removed to reduce pressure on their forage. Seventy-five were transferred to Theodore Roosevelt National Memorial Park, restoring the species there; 12 were placed in Wind Cave National Park, where poaching and other factors have reduced the herd.

Public Law 787, which added most of the former Jackson Hole National Monument to Grand Teton National Park, passed too late to permit application of its provisions for the controlled killing of elk in a portion of the park lands formerly in the monument; without such control, 685 elk were killed. For the coming season, a kill of 600 on park lands has been recommended on the basis of joint studies by the Wyoming Game and Fish Commission and the Service. These are to be taken by licensed Wyoming hunters deputized as rangers, as provided in the new law.

The completed 5-year study of coyote migrations in and around the northern part of Yellowstone showed that about one-quarter of the animals raised or summering in the park leave it permanently in the fall and winter. To protect livestock from possible damage, the Fish and Wildlife Service will institute control measures outside the park.

Do Not Feed the Bears

The education of visitors to understand that bears are wild animals, and dangerous, continues to be a major problem in those parks which have black bear populations. While enforcement of the regulation which prohibits feeding, teasing, or molesting bears is a difficult matter, special effort is being directed toward it. As reinforcement, the Service has issued, for distribution with informational publications, a small insert, depicting an upraised bear with formidable claws and teeth, and carrying a short warning legend.

Endangered Species of Plants and Animals

The sanctuary character of the national parks and monuments and the careful protection of plant life within them make them particularly important in preserving endangered species. In Everglades National Park the survival of the manatee seems assured; recent studies by Service personnel, particularly the biologist assigned to Everglades, have added greatly to our knowledge of this remarkable and rare mammal.

The bighorn sheep has now become permanently reestablished in Mesa Verde National Park, and bighorns are on the increase in Rocky Mountain National Park. They appear to be decreasing in Glacier and Yellowstone National Parks. The status of the trumpeter swan is improving slowly. Considerable numbers of black-footed ferret, once thought extinct, have been found near Wind Cave National Park. Steps are being taken to introduce them into the park and into Theodore Roosevelt National Memorial Park, in an attempt to reestablish this vanishing species.

In Mount McKinley National Park, the Dall sheep continues to show a gratifying increase in numbers.

Seven nene, the rare Hawaiian land-loving goose—the first flock seen in 3 years, and the largest since 1937—were observed in Hawaii National Park early in June. Once abundant throughout the islands, particularly on Hawaii, they have been so reduced by hunters, predators, and adverse land uses that they are rarely seen. This flock was discovered on the Mauna Loa strip, a narrow parcel of land jutting up to the summit of Mauna Loa.

Hurricane winds in August and September of last year destroyed many of the sooty and noddy terns which each year nest on Bush Key, in Fort Jefferson National Monument. A census of these birds is taken annually. That taken last spring shows a drop in the sooty tern population from 191,000 in 1950 to 168,770 this year. However, the noddy terns showed an increase from 538 to 570 and roseate terns from 126 to 140.

Until recently, there was but a single known specimen of the plant, *Hibiscadelphus giffardianus*, a native of Hawaii. During the past year, however, slips from this plant have been successfully propagated in Hawaii National Park. Seedlings of such rare native plants as the silversword, loa, wiliwili, and kaula have been germinated and planted in the park in an attempt to restore important species to something like their former abundance.

Fishing Regulations for Everglades Issued

Previous annual reports have indicated the need of regulation of fishing and fishing practices in Florida Bay and other salt-water areas of Everglades National Park. Following publication of proposed regulations in the Federal Register, a public hearing was held in Homestead, Fla., last November to learn the public reaction to them. Interest was keen; organizations with a total membership of 30,700 were represented. Main target of the regulations was the drag seine, which was destroying the fisheries of Florida Bay, and was endangering the bird and animal life of the area by destroying their food.

The regulations were promulgated by Secretary Chapman in March. Sports fishermen, conservationists, and most commercial fishermen strongly endorsed his action.

Scientific Projects

In recent years, observers both within and outside the National Park Service have been concerned over the possibility that the necrosis affecting the mature saguaro cactus in Saguaro National Monument, Ariz., was killing off these giant cacti much more rapidly than it was being replaced by new growth. Preliminary studies indicate that this extraordinarily interesting plant is holding its own or even gaining a little. * * * University of Arkansas scientists conducted studies on the radioactivity of thermal waters and its relationship to the geology and geochemistry of uranium, at Hot Springs National Park. The study is being continued under a grant from the Atomic Energy Commission. * * * Although a number of Service-administered areas are likely to be directly or indirectly affected by current cloud-seeding projects, all requests for permission to install cloud-seeding generators within any of these areas have been denied. * * * There is need of detailed biological studies in a number of areas, particularly in Olympic, Yellowstone, and Grand Teton National Parks, to provide a completely scientific basis for any wildlife management measures which may be required.

IN THE MUSEUM FIELD

The responsibilities of the National Park Service in what, for want of a better term, is referred to as the museum field are extraordinarily varied. They include museum planning in all its stages; the design and construction of a wide range of exhibits; protection of fragile and destructible exhibits; the repair of various artifacts—paintings, tapestries, draperies, and furniture—in historic buildings; and the training of personnel in the care of museum materials.

For the first time, funds were allotted for the prevention of deterioration of valuable and, in many cases, irreplaceable, museum collections. Dehumidifying equipment was obtained for 4 areas and storage cabinets for 19. Expert treatment of specimens in a state of deterioration can now be given in limited amount by the small staff of preservation specialists. The jobs performed were varied—preservative treatment of metal objects at Colonial National Historical Park, of historic portraits at Independence Hall, of western scenic paintings at Yosemite National Park, of valuable furniture at Vanderbilt Mansion National Historic Site, and of important portraits at Adams Mansion National Historic Site.

More exhibits were prepared than in any year since 1941. Among the more important ones were those for Chickamauga and Chattanooga National Military Park, Ocmulgee National Monument, Custer Battlefield National Monument, Hawaii National Park, and the Independence National Historical Park project. The completion of the museum at Ocmulgee, begun in the 30's, and the building of the museum at Custer Battlefield were the two major construction projects of the year. The third in-service training course, for a small group of persons with responsibilities in museum work in field areas, was conducted in Washington during the spring.

Hui O Pele (Society of Pele), with a donation of $2,500, brought its total donations for museum development in Hawaii National Park during the last year and a half to approximately $10,000. Only persons who visit Kilauea Volcano are eligible to membership in the society. Membership certificates sell for $1 and are held by more than 30,000 persons throughout the world. Funds so obtained by the society are devoted wholly to the provision of facilities for the benefit and enjoyment of visitors to Hawaii National Park.

THE FORESTS OF THE NATIONAL PARK SYSTEM

Both during the calendar year 1950 and the fiscal year just ended, by far the greater part of the acreage burned over in the National Park System was in Everglades National Park. In the calendar year—the period required to be covered by fire reports under the Clarke-McNary Act—a fire swept into the park early in May during a period of severe drought and high winds. Before it could be controlled, it had covered 31,120 acres of park land. Though conditions were severe, this fire was controlled without benefit of rain—the first time on record that such a fire had been controlled in the Everglades solely through human effort. This single fire burned 91.7 percent of the total areas burned inside park areas during the year.

June of 1951 brought further damage to the vegetative cover of the Everglades. The water table was much below normal because of under-average spring rains; forests and glades were highly susceptible to fire and, in stiff winds, to exceptionally rapid spread. Though few Everglades fires have been caused by lightning, seven such fires were started, and six resulted in extensive burns. A tentative estimate at the end of June places the burned-over area at 42,000 acres, mostly grassland.

During calendar 1950 there was also an unusually heavy incidence of lightning fires in the Southwest and California, relatively few in the Northwest and the Northern Rocky Mountain areas. Despite record-breaking public use, there was a material reduction in the number of man-caused fires.

Civil Defense—Forest and Range Fire Control

The National Park Service, other wild-land management agencies of the Department, other Federal agencies, and State conservation departments have prepared plans for intensified protection from fire damage in the event of hostilities. Park fire control plans have been reviewed to assure that all personnel and facilities from all currently available sources are included. Cooperative agreements and mutual assistance provisions with adjacent agencies were strengthened wherever possible.

Important in this connection has been the holding of joint meetings by the key personnel of this Service in several areas with personnel of adjacent national forests and State forestry organizations to improve cooperative action on large fires. Park Service personnel represent the Department in a number of States in the development of coordinated civil defense wild-land fire control plans.

Disease and Insect Enemies of the Forest

In continued cooperation with the Division of Plant Disease Control of the Bureau of Entomology and Plant Quarantine, steady progress has been made in the protection of white pine forests from blister rust. Of the control area of 357,260 acres in the parks and monuments, approximately 82½ percent has now been worked once to remove currant and gooseberry bushes (the alternate host of the disease), and a substantial acreage has been reworked to remove sprouts and new seedlings. About 56 percent of the total control area is now considered to be in a condition which requires only occasional attention.

Based upon recommendations of and assistance by the Division of Forest Pathology of the Bureau of Plant Industry, Soils, and Agricultural Engineering, a project was initiated to control dwarf mistletoe, which threatened to wipe out ponderosa pine over a considerable area along the South Rim of the Grand Canyon. Aggressive coordinated action by the Bureau of Entomology and Plant Quarantine, the Forest Service, and the National Park Service was continued in an effort to control the very serious epidemic of the mountain pine beetle which has ravaged extensive areas of lodgepole pine in four national forests and Grand Teton National Park. It is hoped that control work performed in the spring of 1951 in Grand Teton will stop further spread of this epidemic toward the vast lodgepole forests of Yellowstone National Park.

For several years, western pine beetle attacks in Kings Canyon, Sequoia, and Yosemite National Parks, in California, had been successfully checked by a moderate amount of maintenance control work. Early last fall, however, it became apparent throughout the

Sierra region that the infestation had increased to epidemic proportions. Accordingly, aggressive action was undertaken last winter by both Forest Service and Park Service to reduce the infestation to endemic status in the parks and the adjoining national forests.

By regular inspections to detect insect attacks and by prompt control of new infestations, the park forests were maintained in a generally healthy condition. This procedure is important in protecting these valuable forests. Small annual expenditures for prompt control, before any infestation becomes widespread, has proven economical and effective—from the standpoint of both dollar expenditure and the saving of the forests.

Tree Preservation

A tree preservation crew of six skilled workers is a field unit of the Region One office. Its responsibility in the care of important individual trees, particularly in the many historical areas, including cemeteries. Mobile and fully equipped, it has proved highly effective in necessary tree maintenance work. During the year, the crew worked in 20 areas. Its labors were sharply increased by the very destructive sleet and windstorms of the South and Northeast during the winter.

PUBLICATIONS

Four historical handbooks, numbers 6, 7, 8, and 9 in this series, came off the presses of the Government Printing Office during the past year. These cover Gettysburg National Military Park, Fort McHenry National Monument, Lee Mansion National Memorial, and Hopewell Village National Historic Site. Readable, accurate, and well-illustrated, they are also handsome in outward appearance—first-rate examples of the sort of work performed by the Division of Typography and Design, Government Printing Office. Handsome also, and a real contribution to the archeology of the Southeast, is Archeology of the Bynum Mounds, Mississippi, by John L. Cotter and John M. Corbett, Service archeologists. This is the first of what is hoped will be a series of publications on archeological research.

The Service has continued to produce and distribute the various kinds of free informational literature that are required for satisfactory use and enjoyment of the parks and monuments. During the year, orders were placed for 6,354,000 pieces of such literature, for a total of 103 items.

Literature issued by the Service is valuably supplemented by publications of cooperating natural history associations and similar organizations. More than a score of these were produced during the past year.

FOR GREATER SAFETY

During the calendar year 1950, there were 33 accidental fatalities among National Park System visitors, a decrease of 16 from the 49 recorded the year before. Of this total, motor-vehicle accidents were responsible for 14, drownings for 13, and falls for 4. One death resulted from accidental shooting; for one, the cause is unknown.

In the hope of reducing motor-vehicle accidents still further, maps have been prepared to show trouble spots, with a view to correcting conditions which may contribute to accidents.

The Service's Chief Safety Engineer made a thorough study of Independence Hall and its associated buildings soon after administration of these priceless structures was assumed by the Service. Some of the important changes recommended have already been made and others are in progress.

NECROLOGY

Oliver G. Taylor, Chief of the Public Services (now Concessions Management) Division, died suddenly in Washington, D. C., on August 26, 1950. Mr. Taylor, whose service with the Federal Government began with the Geological Survey in 1909, and who came with the National Park Service in 1919 as park engineer at Yosemite National Park, thereafter occupied with distinction a succession of increasingly responsible positions. Among them were those of chief engineer of the Service, regional director of Region One, and chief of Public Services. Few men in the history of the National Park Service have earned as great a degree of respect and affection as did Oliver Taylor.

Ernest F. Coe, whose long labors in behalf of the establishment of Everglades National Park were crowned with success in 1947, died in Florida last December.

Duncan McDuffie, for many years a member of the Yosemite Advisory Committee, and a courageous and wise leader in conservation, died at his home in Berkeley, Calif., on April 21, 1951.

Luther Ely Smith, of St. Louis, widely regarded as the founder of the Jefferson National Expansion Memorial on the St. Louis waterfront, died on April 2.

COOPERATION OF MANY KINDS

It is highly important to the people of the United States that adequate consideration be given to the conservation and development of outdoor recreation resources which will be affected by water-control projects. Federal programs for power, flood control, navigation improvement, erosion control, and irrigation are radically changing the natural character of rivers and lakes, the recreational use of which people have taken for granted for generations. Many of these projects probably will enlarge existing recreation opportunities and, when properly planned and developed, create new ones. Some projects, however, are destructive of recreation resources of great public importance. Rapid acceleration of the basin-wide recreation studies, which the National Park Service is conducting in cooperation with other Federal agencies and the States, is of vital importance both for the protection and best use of outdoor recreation resources and to bring balance into the vast water-control programs of the Federal Government.

River Basin Studies

It is encouraging, therefore, to report that basin-wide recreation studies have been begun in the Arkansas-White and Red River Basins and the Missouri River Basin, and a recreation study of the New England-New York area was started. Study of the Rogue River Basin in Oregon was continued, and the University of Oregon agreed to assist by making a study of the economic importance of recreation in the Basin.

Continuing its cooperation with the Bureau of Reclamation, and, upon request, with the Corps of Engineers, the Service made recreation planning studies on 70 reservoir sites and continued such studies on 30 others. Community planning consultant services also were rendered to the Bureau. During the year an agreement was entered into with the Nebraska State Game, Forestation and Parks Commission for the management of the recreation facilities at Reclamation reservoirs in the State. The Idaho Legislature authorized the State to enter into an agreement for the management of recreation developments at American Falls and Lake Walcott Reservoirs; similar agreements for State and local management of reservoir recreation facilities were being negotiated in several other western States. Though advocated by the Department, authority for Federal development of recreational facilities on a nonreimbursable basis, such as the Corps of Engineers possesses, has not been granted with respect to Reclamation reservoirs.

Cooperation With the States

During the year the Service sought and received excellent cooperative assistance from the States in river basin recreation studies. Likewise, it gave information and advice, upon request, on the administration, planning, development, operation, and maintenance of State parks to nearly every State which has a park system. Data and interpretation concerning National Production Authority orders affecting the construction and maintenance of recreation facilities in State parks were also provided. Advice was also given on State parks enabling legislation and on State civil-service examinations. Service personnel participated in several in-service-training institutes.

State Park Statistics—1949, issued during the year, contained an extensive study of State park personnel. It listed all classes of employees for headquarters offices and areas, and salary scales for each. List of State Parks, With Acreages and Accommodations, a complete up-to-date inventory of State parks and related recreation areas throughout the country, and State Recreation Areas, containing brief descriptions of the major State parks and other recreation areas in each State, were also issued during the year.

Surplus Property Disposal

The program of surplus property disposal, for recreational and historic site purposes, was confined largely to the investigation and determination of compliance, by the grantees of surplus properties, with the terms and conditions of the instruments of conveyance. Only four new disposals were processed. All surplus properties were rescreened by the Munitions Board for possible military use. As a result, many installations that were being considered by State and local government agencies have now been withdrawn from surplus.

Cooperative Agreement With Reclamation Approved

Last July, Secretary Chapman approved a joint agreement between the National Park Service and the Bureau of Reclamation defining the responsibilities of each in the cooperative relationships which have existed between them for a number of years. From the Service's standpoint, major importance attaches to the provision for early information, at the regional level, regarding all projects to be investigated and all projects authorized for construction; and for early consultation, during the planning stages, so that the Service can advise on location of roads, structures and other elements of construction, for appearance and to obtain maximum recreational benefits.

Several of the principal provisions are similar in character to those in previous agreements which have been limited in application to single projects or groups of projects. The general agreement eliminates the need of such special agreements in the future.

International Cooperation

Interest in the National Park System and the way in which it is managed seems to increase with each year among residents of other countries, though perhaps heightened at present by programs sponsored by the State Department for bringing specially selected foreigners to the United States. The launching of a national park program in Great Britain has certainly heightened the interest of visitors from that country in the parks of the United States.

After several years of acquaintance with the National Park Service through correspondence, Col. Mervyn S. Cowie, who heads the Royal National Parks of Kenya Colony, British East Africa, spent about 2 months last fall on a tour of our national parks, during which he was given every opportunity to see them in operation and to observe administrative practices and public use. He was an honored guest at the Service conference in Yosemite National Park.

Minoru Iijima, Director of National Parks of Japan, made a study of the national parks of the United States last summer and autumn, having been selected for the study by the Supreme Commander of Allied Powers in Japan. During his 11 weeks in this country he visited many of the major parks, West and East, as well as numerous historical areas of various kinds. National park administration is a function of Japan's Ministry of Welfare.

At the request of the National Parks Board of Trustees of South Africa, Chief Biologist Victor H. Cahalane spent 4 months in a study of their national parks. A grant from the Carnegie Corporation of New York financed the mission. His report to the Board made recommendations concerning a wide variety of phases of park planning, development, and management. At the invitation of the Portuguese Government, he also spent 10 days in Mozambique advising officials regarding park and nature protection in that province. Mr. Cahalane was also invited to visit the national parks of Belgian Congo and Kenya to consult with officers in charge on management and protection of the reserves.

The National Park Service was represented by Mr. Cahalane at the second general assembly of the International Union for the Protection of Nature at Brussels last October. He was appointed chairman of the Consultative Commission of the Union's Survival Service.

Interested in the proposed restoration of the Cocospera Mission in Sonora, Mexico, Governor Soto, of Sonora, and Lions Clubs District Governor Urquides, of Magdalena, Sonora, sought advice as to methods and procedures for accomplishment. To supply it, Superintendent Jackson, of Tumacacori National Monument, Ariz., spent a week in May on a study of mission churches in Sonora, and prepared a report, with detailed suggestions on stabilization possibilities at Cocospera. Governor Soto was given a copy of the Service's Stabilization Manual, and was assured of advisory assistance in connection with the restoration, if desired.

Alaska Recreation Resources Study

The survey of the recreation resources of Alaska, begun in 1950, was continued on a somewhat larger scale during the past year when extensive investigations were made of scenic, historical, archeological, and biological resources. Studies of social and economic conditions were also undertaken by the University of Washington under contract. The survey is intended both to appraise the territory's recreation resources and to formulate a program for meeting recreational and tourist needs, to serve as a guide to both Government and private enterprise.

PERSONNEL MANAGEMENT

In the field of personnel management there were few notable developments. However, recruiting difficulties which the emergency situation had brought about began to be felt at the start of the year, and at its close were becoming greater. Shortages in certain fields, including engineering, archeology, stenography, and typing, were as severe as at any time during World War II. Turnover in these fields, particularly in stenographic and typing positions, was at a high rate which had begun to increase somewhat toward the end of the year; many employees were leaving to accept higher paid defense-agency jobs.

The increasing rate of turnover and the difficulty of finding adequate replacements have had their effect in lowering the ability of the Washington office and of many of the field areas to meet the workload demands. These factors also have pointed up the need for taking whatever measures can be taken to reduce turnover and to train new employees more effectively. So that the training program might be developed more rapidly to meet the new needs of the Service more effectively, a training officer position was filled at the end of the fiscal year.

The workload and the complexity of procedures in handling personnel transactions were somewhat increased when, effective December 1, the Civil Service Commission suspended the regular civil-service rules and instituted temporary regulations which are closely similar to those in effect during World War II. Although the rate at which our employees have been entering the Armed Forces has been low, it has been increasing in recent months somewhat, and the cumulative total of military furloughs is beginning to assume significant proportions.

THE LAND PROGRAM

On July 1, 1950, non-Federal lands and waters within the areas of the National Park System were estimated at 662,000 acres, including approximately 128,000 acres in Everglades National Park of which all were acquired during the year just past. Some 22,000 acres in other areas were acquired.

Purchases and Options

Title was accepted on approximately 1,500 acres of land and improvements costing about $175,000 and option contracts were obtained on an additional 12,600 acres and improvements to cost about $120,000. These transactions involved lands in 13 areas of the National Park System. They included 16 separate parcels, containing 1,140 acres and costing $72,000, in Rocky Mountain National Park; 10 parcels, totaling 400 acres and costing $50,000, in Glacier National Park; 4 parcels, including two highly important tracts, containing 175 acres and costing $45,000, in Yosemite National Park; and 11,819 acres in Joshua Tree National Monument, being purchased from the Southern Pacific Railroad for $10,785. Included also were important properties in Colonial National Historical Park and in Gettysburg and Petersburg National Military Parks.

On December 4, 1950, the United States, through a "declaration of taking," obtained title to the 128,000 acres, until then privately owned, within the "1944 boundary" of Everglades National Park. Two months later, by court order, the United States obtained physical possession of most of this acreage; on June 1, 1951, it obtained possession of the remainder. At the end of the fiscal year the Service had expended about $1,100,000 of the $2,000,000 donated by the State of Florida in 1947 for the purchase of lands within the 1944 boundary. The total expended includes $320,459 paid into the court as estimated just compensation for the lands included in the declaration of taking.

The acquisition program in connection with the Independence National Historical Park project is summarized elsewhere in this report.

Progress on Authorized Projects

The prospect of establishing Harpers Ferry National Monument, authorized by Congress in 1914, became considerably more real when the State of West Virginia appropriated $350,000 for the purchase of lands in that State for the project. This money was to become available on July 1, 1951. A year later, Maryland will have $40,000 for the purchase of its portion of the area.

The State of Tennessee, Hamilton County, Tenn., the city of Chattanooga, and private donors would join in purchasing lands in the famous Moccasin Bend of the Tennessee River, authorized by Congress for addition to Chickamauga and Chattanooga National Military Park.

Revised tentative boundaries for the Cape Hatteras National Seashore project were worked out with the State of North Carolina. The State has not resumed its acquisition activities, however, though there continues to be considerable local interest in going ahead with the project.

Additions and Subtractions

Grand Teton National Park was enlarged from 95,360 acres to 298,738 acres with the passage of Public Law 787, Eighty-first Congress. This act of Congress added to the park most of the former Jackson Hole National Monument, and made it possible to go ahead with the planned protection and development of this magnificent area. * * * Joshua Tree National Monument was reduced by 289,500 acres to 427,096 acres by the act of September 25, 1950. This eliminated mining properties unobtainable for monument purposes. * * * Lava Beds National Monument was enlarged by Presidential proclamation to include lands at the detached petroglyph section and the southern portion of Mammoth Crater. These additions, 211.13 acres in extent, brought the area of the monument to 46,162 acres. * * * Part of Hackberry ruin which was inadvertently omitted from Hovenweep National Monument, in Colorado and Utah, at the time of its establishment, and Goodman Point ruin, were added to it by Presidential proclamation. * * * With the concurrence of the Department, Wheeler and Holy Cross National Monuments, both in Utah, were abolished by congressional action and the former monument lands were reincorporated in national forests. * * * Also with the concurrence of the Department, Congress authorized the transfer of the Atlanta Campaign Markers, a national historic site, to the State of Georgia. It awaits the enactment of State legislation to permit acceptance. * * * Muir Woods National Monument was also enlarged by Presidential proclamation. Of the 72 acres added, 42 were donated to the United States by the William Kent Estate Co., owned by the heirs of the late Representative and Mrs. William Kent, who gave the people of the United States the land comprising the original monument. Part of Mount Tamalpais State Park (19.09 acres) is also included under a 25-year lease entered into with the State of California last fall.

In June, an important tract of 4.77 acres was added by purchase to Fort Frederica National Monument. Congress had previously authorized an increase in the size of the monument from 80 to 100 acres. * * * At Acadia National Park, 85.73 acres of land were added by donation; 13.35 acres passed out of the park, under authority granted by Congress—4.90 for the Jackson Memorial Laboratory (for which 60 acres were given in return), and 8.45 for a school building site.

The Sand Beach and Great Head properties, donated by Mrs. Eleanor Morgan Satterlee in 1949, subject to life tenure of a part of them, will soon be in unrestricted Government ownership, Mrs. Satterlee having died last April.

The Twentynine Palms Corp. donated 57.84 acres at Twentynine Palms to Joshua Tree National Monument for use as headquarters and contact station. The Iowa Legislature passed an act authorizing the Conservation Commission to transfer to the United States 204.39 acres which lie within the boundaries of Effigy Mounds National Monument. * * * Secretary Chapman executed a quitclaim deed to the city of Greenville, Tenn., for 656-foot-long Monument Avenue, a city street, which had been a part of Andrew Johnson National Monument.

Donations of Land

Some 6,200 acres of land were donated to the Federal Government for inclusion in units of the National Park System. Jackson Hole Preserve, Inc., through Mr. Laurence S. Rockefeller, its president, added 1,158 acres to the many thousands previously received through Rockefeller generosity and included in Grand Teton National Park. The State of Tennessee provided 1,063 acres for the Natchez Trace Parkway. The National Board of Missions of the Presbyterian Church gave a 0.30-acre lot at the entrance to Sitka National Monument. Other land donations are noted elsewhere in this report.

Exchanges

Approximately 7,000 acres were acquired through exchange. About 5,500 acres of Southern Pacific Railroad land in Joshua Tree National Monument were obtained in exchange for public domain lands outside the monument. The State of South Dakota conveyed 1,310 acres of State land, for inclusion in Wind Cave National Park, in exchange for part of the former Custer Recreational Demonstration Area. In Olympic National Park, salable windthrown timber was exchanged for 194 acres of privately owned land, including the La Poel Resort and Beach on Lake Crescent and Storm King Inn. Many thousands of additional acres are involved in other exchanges still pending, particularly at Joshua Tree and Saguaro National Monuments and Theodore Roosevelt National Memorial Park.

Two New Monuments Established

Early last July, Castle Clinton National Monument, on the southern tip of Manhattan Island, was established in accordance with legislation approved by Congress nearly 4 years earlier. Title to the historic structure, successively fort, auditorium, immigration station, and aquarium, was transferred to the Federal Government by the city of New York, under authority granted by the New York State Legislature.

In June 1951, George Washington Carver National Monument was finally established. Authorized by Congress in 1943, establishment was delayed by the limitation of $30,000 for acquisition and development imposed in the 1943 act. Last October, after condemnation proceedings had resulted in an award of nearly $79,000, the limitation was amended to $150,000—a sum still inadequate to provide necessary development for visitors. Dr. Carver, the distinguished Negro scientist, who was born of slave parents on the site of the monument in 1860, died in 1943.

THE PARK SYSTEM OF THE NATIONAL CAPITAL

The new amphitheater in Rock Creek Park, completed in 1950 with National Capital Sesquicentennial funds, was dedicated as the "Carter Barron Amphitheater" on May 30, 1951, honoring the memory of the late Carter T. Barron, vice chairman of the National Capital Sesquicentennial Commission, who died November 16, 1950. * * * The four 19-foot equestrian statues cast in Italy as a gift to the people of the United States from the people of Italy arrived in Washington on June 7 and have been placed on the pedestals at the entrance of the Arlington Memorial Bridge and the Rock Creek and Potomac Parkway. They will be dedicated on Columbus Day, October 12, 1951. * * * A new 1,148-acre park, tentatively named Greenbelt Park, was added to the National Capital Park System by transfer from the Public Housing Authority. The Baltimore-Washington Parkway will pass through this area. Extensive recreational development is planned for it, to serve both parkway travelers and residents of Northeast Washington. * * * The germination of two Indian lotus seeds, believed by Japanese and American paleontologists to have great antiquity, by National Capital Parks horticulturists received widespread notice in the press and in scientific journals. The seeds were provided for experimentation by Dr. Ralph W. Chaney, University of California paleontologist and member of the Advisory Board on National Parks, Historic Sites, Buildings, and Monuments.

Roads and Parkways

Upon completion of a contract for a 3.46-mile section of the Baltimore-Washington Parkway let last December, 9.5 miles of the 18-mile development will have been graded. Contract drawings were prepared, contracts let and work begun on seven grade separations and two river crossings during the year. These provide for all major structures on the parkway and represent an expenditure of $2,964,-

180.75. * * * Following final inspection early in the month, the 0.9-mile sector of the George Washington Memorial Parkway above Key Bridge in Virginia was opened to traffic on December 16, 1950.

INVITING IN THE NEIGHBORS

Chamber of Commerce, store, restaurant, and hotel employees and many other persons in communities in the neighborhood of national parks and monuments are important sources of information about them. They are so important, from the standpoint of assuring visitors correct information, that it is worth some effort to educate them. This has been done, with real benefit to the public, at several areas, and the "students" have had a pleasant time of it while absorbing their education.

One of the notable efforts in this direction is that of Grand Canyon National Park. With the cooperation of the Fred Harvey Co. and of Navahopi Tours, business people and public contact employees of Flagstaff and Williams have been given an opportunity to see the park, to learn how it is operated, and to acquaint themselves with available provisions for the visitor. The success of the 1950 "Show Me" day in which Williams people participated led the American Automobile Association office in Phoenix to request a similar privilege, and last April the office manager and 10 employees spent a full day in the park.

Last October, the Superintendent of Big Bend National Park arranged for a group of leading citizens of Alpine and Marathon to acquaint themselves at first hand with the only national park in the Lone Star State. Superintendents throughout the National Park System are encouraged to make a special effort to see that their neighbors are accurately informed about the areas of which they have charge. Several of them have done particularly valuable work in widening public understanding of the Antiquities Act and the importance of its enforcement as a means of conserving the treasures of prehistory.

CHANGES IN SERVICE PERSONNEL

With the resignation of Director Newton B. Drury, effective April 1, he was succeeded by Arthur E. Demaray, associate director since 1933. Conrad L. Wirth, assistant director, became associate director. Ronald F. Lee, chief historian, was made an assistant director. All three are career men, and promotion on a career basis throughout the Service is more firmly established by their appointments.

Death, retirements, and the reorganization of the regional offices occasioned an unusual number of shifts and promotions of Service personnel, of which the more important are:

In the Washington Headquarters Office: Donald E. Lee, assistant chief counsel to chief of concessions management; Herbert E. Kahler, assistant chief historian to chief historian; Leland F. Ramsdell, assistant personnel officer to personnel officer; William A. Schnettler. administrative assistant to chief of general services; Irving C. Root, superintendent of National Capital Parks to townsite planner.

In the regional offices all four associate regional directors became assistant regional directors. In addition: O. A. Tomlinson, regional director, Region Four, retired; Lawrence C. Merriam, regional director, Region Two, to regional director, Region Four; Howard W. Baker, assistant regional director to regional director, Region Two; E. S. Zimmer, chief, Major Roads Branch, Design and Construction Division, Washington, D. C., to assistant regional director, Region One; John S. McLoughlin, superintendent, Grand Teton National Park, to assistant regional director, Region Two; James V. Lloyd, chief of public services, Region Three, to assistant regional director, Region Two; Robert G. Hall, chief, Landscape Architecture Branch, Design and Construction Division, Washington, D. C., to assistant regional director, Region Two; Hugh M. Miller, personnel officer, Washington, D. C., to assistant regional director, Region Three; Harvey H. Cornell, regional landscape architect to assistant regional director, Region Three; Sanford Hill, regional landscape architect to assistant regional director, Region Four; Raymond E. Hoyt, regional chief of land and recreational planning to assistant regional director, Region Four.

Alfred C. Kuehl, park landscape architect to regional landscape architect, Region Four; Duncan Mills, Bureau of Reclamation to regional chief of concessions management, Region Four; W. L. Bigler, park landscape architect to chief, California Central Valley division, Region Four; J. N. Gibson, Department of Agriculture to chief, State Cooperation Division, Region Four; Merritt Barton, attorney, chief counsel's office, Washington, D. C., to regional attorney, Region Three; A. M. Koehler, Federal Bureau of Investigation to chief of concessions management, Region Three; Jerome C. Miller, regional landscape architect, Region Two, to the same position in Region Three; Louis P. Croft, chief, Basin-wide Surveys Branch to chief recreation planner, Region Two; C. E. Krueger, landscape architect to chief landscape architect, Region Two; J. B. Cabot, architect to regional architect, Region Two; James W. Holland, superintendent, Shiloh National Military Park, to regional historian, Region One.

In the field areas: Thomas Boles, superintendent, Hot Springs National Park, retired; Donald S. Libbey, superintendent, Carlsbad Caverns National Park, to superintendent, Hot Springs; R. Taylor Hoskins, superintendent, Mammoth Cave National Park, to superintendent, Carlsbad Caverns; Thomas C. Miller, superintendent, Platt National Park, to superintendent, Mammoth Cave; Perry E. Brown, assistant superintendent, Mesa Verde National Park, to superintendent, Platt; Edward D. Freeland, superintendent, Shenandoah National Park, to superintendent, Grand Teton National Park; Guy D. Edwards, chief recreation planner, Region Two, to superintendent, Shenandoah; Melford O. Anderson, assistant project manager to superintendent, Independence National Historical Park project; Edward J. Kelly, assistant superintendent to superintendent, National Capital Parks; Harry T. Thompson, assistant superintendent to associate superintendent, National Capital Parks.

Alfred A. Knopf, New York publisher, and Charles G. Woodbury, of Washington, D. C., prominent in many conservation activities, were appointed to the Advisory Board on National Parks, Historic Sites, Buildings, and Monuments by Secretary Chapman, as successors to Dr. Waldo G. Leland, of Washington, D. C., and Mrs. Reau Folk, of Nashville, Tenn., whose terms had expired. Dr. Leland, long chairman of the Board, continues to assist the Service as a collaborator. Mrs. Folk had been a member of the Board since its establishment in 1936.

NOTES FROM AROUND THE FIELD

Zion National Monument

Zion National Monument, established in 1937, possesses distinction, particularly as a geological exhibit. Adjoining Zion National Park on the north, it is known to comparatively few people and has remained undeveloped. Service employees and others have made a number of trips into it during the past year to analyze its values and to formulate a policy of development and use for it. Of great interest is the fact that a natural bridge on a small tributary of La Verkin Creek may be the largest of its kind known in the world.

Study of Yellowstone Travel

An indication of Yellowstone National Park's drawing power as a travel objective and of its influence on the economy of the surrounding communities is found in Yellowstone National Park Tourist Study—1950. This report, published by the Wyoming Highway Department, was based on a study conducted in the park last August by that department in cooperation with the Bureau of Public Roads and the National Park Service. It shows that nearly half of all the visitors to the park left their homes primarily to see it. In and near the park they left nearly $19,000,000—$6,000,000 in the park, $6,076,055 in Wyoming, $4,790,710 in Montana, and $2,116,536 in Idaho.

Cooperating Associations

The interpretive programs of the Service are assisted in steadily greater degree by the cooperating associations which exist in a number of national parks and monuments or which represent a group of areas. Supported largely by contributions, and by the issuance and sale of publications, they have again supplied funds for the purchase of a great variety of books and equipment for which appropriated funds were not available. The Glacier Natural History Association bought and conveyed to the Government an additional tract of private property in the park, and increased its available funds for land acquisition.

Winter Use

Mount Rainier, Olympic, Crater Lake, Lassen Volcanic, Yosemite, Sequoia, and Rocky Mountain National Parks continued to offer winter sport facilities. However, there were fewer demands upon the National Park Service for the provision of additional conveniences. This was due to improved winter sports developments outside the parks and a better understanding of Service problems of winter maintenance and operation.

Yosemite's Field School

The Yosemite Field School of Natural History had one of the most successful sessions in its 25-year history during the summer of 1950. The school has given important training to many park naturalists employed by the Service now and in the past, or employed by other public or semipublic agencies. Primarily it provides instruction, based on practical experience, in the techniques of natural history interpretation as practiced by the Service.

Helicopters at Grand Canyon

The Arizona Helicopter Service began operating flights over Grand Canyon National Park in June 1950. Tusayan Auto Court, just outside the park on highway 64, was the starting point of the flights. The operator of this service had been denied permission to establish a business in the park, but there was neither law nor regulation to prevent his operating over it; nor do the safe height limits for airplanes apply to helicopters. Deliberately irritating incidents were a daily occurrence, with very low flying over the Grand Canyon Village area disturbing visitors and residents and, in some cases, scheduled programs.

One machine was wrecked in a rescue operation in June 1950 when two members of the Hudson Marston Expedition were brought out of the canyon. A forced landing, followed by a crash on attempted take-off, wrecked another machine. Since then, no further flights have been made.

Service Conference at Yosemite

A biennial conference of Service personnel, chiefly superintendents, was held in Yosemite National Park October 16 to 20, inclusive. Part of the conference was attended by Assistant Secretary Dale E. Doty, who addressed the opening session. A morning and an afternoon session were held at Glacier Point and the Mariposa Grove, respectively.

Awards for Distinguished Service

Theador McCarrell, who died on August 2, 1950, as a result of injuries received while fighting forest fire in the Jones Hole section of Dinosaur National Monument, was awarded posthumously the Department's Distinguished Service Award for his supreme devotion to duty.

The same award was given to Owen A. Tomlinson on his retirement from the post of regional director, Region Four, and to Dr. Waldo G. Leland, in recognition of his notable service as member and chairman of the Advisory Board on National Parks, Historic Sites, Buildings, and Monuments.

Temporary Administration of Angel Island

Under a memorandum of understanding with the Bureau of Land Management, to which Angel Island, in San Francisco Bay, had been transferred for disposal, the National Park Service has undertaken temporary responsibility for its administration and protection. Funds to meet the costs of administration and protection have been furnished by the Angel Island Foundation, a nonprofit corporation of San Francisco.

Long's Peak Climbs

Long's Peak, 14,255 feet high, in Rocky Mountain National Park, continues to offer one of the most popular climbs in America; 1,851 persons ascended it during 1950. The difficult East Face was ascended by 118 of these, a new record for this climb.

Mojave Lake, Filled, Attracts Fishermen

Mojave Lake, impounded by Davis Dam, and a part of Lake Mead National Recreational Area, has now reached the elevation at which it is expected to be maintained. Concessions established at three points on the lake have provided acceptable service, but the lake has attracted fishermen and those who seek enjoyable boating far beyond their capacity to care for them. Negotiations for establishment of another concession operation are progressing encouragingly.

Assignments to Glacier Bay

Assistant Chief Ranger Duane D. Jacobs of Yosemite National Park was given a temporary assignment during the summer of 1950 to Glacier Bay National Monument, Alaska—the first time that the Service has assigned any employee to that vast area to give it a measure of protection. On May 1, 1951, District Ranger Oscar T. Dick was transferred from Mount Rainier National Park to serve as special ranger at Glacier Bay. During the summer of 1950 Canadian Pacific Steamship Lines operated excursion trips into the monument, and the National Park Service produced a twofold informational folder on it—the first such publication produced for this magnificent but little-visited area.

Giant Geyser More Active

The Giant Geyser, in Yellowstone National Park, which ordinarily erupts once or twice a year, was recorded as having erupted six times during the month of May alone. These were normally between 5 and 6 days apart, though the first and second were separated by only a little more than 2 days.

Trash Bags

Careless disposal of trash has long been a serious maintenance problem of the National Park Service. However, experience over the past year has shown that it can be considerably alleviated. At the suggestion of District Ranger Gordon K. Patterson, Superintendent Preston, of Mount Rainier National Park, obtained a quantity of stout paper bags. On them was printed a message inviting park visitors to use the bags as a container for trash until it could be deposited in a trash can, and urging them to help maintain the beauty of their national park.

Results were so good that last year's original order for 10,000 bags was increased by 50,000. The time required for roadside clean-up has been greatly reduced. This season, such bags are being used throughout Region Four. Another year will doubtless see them being distributed from all Service areas where contact points are maintained.

Crash of Plane on Mount Moran

On the evening of November 21, an airplane owned by the New Tribes Mission, en route from Chico, Calif., to Billings, Mont., crashed on the northeast ridge of Mount Moran, in Grand Teton National Park. All of the 21 persons aboard lost their lives in the crash. Starting on November 23, Paul Petzoldt, guide concessioner at Grand Teton, who had returned to the park from his home at Riverton, Wyo., for the purpose, and Blake Vandewater, park ranger, made the very hazardous climb to the scene of the crash, where they arrived about noon of November 25 after spending 2 nights on the mountain. An attempt to dispatch rescue forces to the scene on November 22 had proved unsuccessful, due to blizzard conditions. Paul A. Judge, chief ranger and acting superintendent of the park, was in charge of all rescue operations.

A board of inquiry, which convened on November 26 and in which three representatives of the Civil Aeronautics Board and two representatives of the Civil Aeronautics Administration participated, concurred in recommendations by Messrs. Petzoldt and Vandewater that no attempt be made during the winter to remove material from the wreckage or even to climb again to the site because of the heavy hazards involved.

Visitors

The visitor total for all areas administered by the Service during the 1950 travel year (Oct. 1, 1949, to Sept. 30, 1950) was 32,782,238. The 31,864,180 total for the year before included 1,980,876 at Lake Texoma, no longer administered by the Service. On a fair basis of comparison, therefore, the increase over the 1949 travel year was 2,898,934—approximately 10 percent.

Dutch Elm Disease in the Capital

The Dutch elm disease, first discovered in Washington, D. C., in 1947, has increased significantly each year since then. From a single case in 1947, the number of infected trees discovered increased to 102 in 1950, and 133 in the first 6 months of 1951. At year's end, groundwork was being laid for much closer cooperation between the Office of National Capital Parks and the District of Columbia Government to control the disease.

Bureau of Indian Affairs

Dillon S. Myer, Commissioner

FOUR MAJOR DEVELOPMENTS stand out in the wide range of activities carried on by the Bureau of Indian Affairs on behalf of the 400,000 Indians of the continental United States and the 35,000 natives of Alaska during the fiscal year 1951.

The first was the launching of a 10-year special program designed to promote the basic welfare of two especially needy Indian groups—the Navajos and the Hopis. Authorization for such a program was provided by Congress in April 1950, and an appropriation of $8,645,520 was subsequently made available for the first year of operations.

Because of a delay in appropriations, work was not started on a really significant scale until the last quarter of the calendar year. Throughout the winter and spring, however, substantial progress was achieved in assembling the necessary personnel, drawing up plans, and initiating the work program on a number of different fronts. The program includes such basic developments as the improvement and enlargement of school facilities, construction of roads connecting key points on the Navajo and Hopi Reservations, soil and water conservation and range improvement, relocation of Navajo and Hopi families on irrigated lands of the Colorado River Reservation, completion and extension of existing irrigation projects, and the development of additional employment opportunities for the Navajo and Hopi people both on and off the reservations.

The second major development of the year was a strengthening of the basic organizational structure developed by the Bureau during the previous year to carry on its activities with a maximum of effectiveness and economy. In essence, the organizational pattern was built around three levels of administration: (1) The national office (2) the 11 area offices, and (3) the agencies or other field jurisdictions.

During 1951, the "housekeeping" functions, such as payrolling and vouchering, formerly performed at the agency level, were transferred to the area offices in order to free the agency personnel for more direct operations with individual Indians and Indian groups.

Another move of similar character was the placing of the nine detached field offices, which were formerly directly responsible to the Commissioner, under the supervision of the appropriate area offices. In this transfer the area office at Phoenix, Ariz., assumed supervision over the Carson agency at Stewart, Nev., and the Western Shoshone agency at Owyhee, Nev.; the area office at Anadarko, Okla., extended its jurisdiction over the Osage agency at Pawhuska, Okla., as well as the Haskell Institute at Lawrence, Kans., and the Chilocco (Okla.) School; the area office at Muskogee, Okla., became responsible for the Choctaw agency at Philadelphia, Miss., and the Seminole agency at Dania, Fla.; the area office at Window Rock, Ariz., took on supervision of the Intermountain School at Brigham City, Utah; and the Minneapolis area office assumed jurisdiction over the Cherokee (N. C.) agency. With the completion of these administrative moves, all field operations of the Bureau were brought under supervision of the 11 area offices.

A third development of prime long-range significance involved a major decentralization of the functions of the Bureau from the Washington level to the area offices and field jurisdictions. Starting in the summer of 1950 the Bureau undertook a comprehensive and systematic examination of the authorities and responsibilities affecting Indian affairs which were exercised by the Commissioner or the Secretary and which might more expeditiously be performed by area directors or agency superintendents located closer to the major centers of Indian population. Before these authorities and responsibilities could be comprehensively delegated, however, the Bureau had to prepare a substantial volume of procedural material designed to inform the area and agency personnel in detail about the proper exercise of their newly assumed responsibilities. This material was planned in the form of an Indian Affairs Manual to consist of more than 150 separate chapters covering every important phase of Bureau activity. By the close of the fiscal year a total of 31 chapters had been completed and distributed to the field and 90 additional chapters were at some stage in the process of preparation or duplication. It was anticipated that the entire job would be completed early in the fiscal year 1952. Meanwhile, a large number of delegations of authority, chiefly affecting land matters and credit operations, had been made from the Commissioner to the area directors.

The fourth development, perhaps the most significant of all, involved a fundamental liberalization of the regulations governing the disbursement of money held by the Bureau's disbursing agents in the accounts of individual Indians (25 CFR 221.1–221.40). Under the regulations previously in effect, only very limited amounts could be disbursed from these accounts to the individual owners without some form of Bureau approval and large numbers of the withdrawals had to be approved by the Washington office. In line with the Bureau's basic policy of gradually withdrawing its supervision over Indian affairs and transferring to the Indians an increasing measure of responsibility for decisions affecting their lives and welfare, it was determined during the year that these regulations should be substantially amended. Under the revised regulations, which were approved by the Secretary and published in the Federal Register toward the end of the fiscal year, the great majority of the approximately 80,000 individual Indian money accounts were freed of all Bureau supervision. Restrictions were retained, however, over the accounts of minors and mental incompetents. The regulations governing the individual accounts of the Osages of Oklahoma, which are different from those affecting the accounts of other Indians, were not modified during the fiscal year but were being studied with a view to similar modification some time in fiscal 1952.

The year 1951 was, in summary, a period of administrative realinement, of continued operation of normal Indian Service functions, and of preparation for more intensive effort to accomplish the Bureau's two long-range objectives: (1) A standard of living for Indians comparable with that enjoyed by other segments of the population, and (2) the step-by-step transfer of Bureau functions to the Indians themselves or to appropriate agencies of local, State, or Federal Government. In order to accomplish these objectives, the basic need was for a group of qualified personnel, free of responsibility for the everyday administration of Indian affairs, who could devote their full attention to the job of developing cooperatively with each of the major Indian groups an individualized program of resource development accompanied by constantly expanding Indian control over the management of their individual and tribal affairs. It was hoped that a program development activity of this kind could be launched on a significant scale in the fiscal year 1952.

HEALTH SERVICES

The mortality and morbidity rates among Indians for whom the Bureau is responsible for providing a health program, continue to decline slowly but still closely parallel the rates that prevailed among the general population some 40 to 50 years ago. During the past year an adequate number of personnel has not been available to staff properly the Indian service hospitals nor to provide field nursing service and an organized disease-prevention program on a scale commensurate with the need. Management improvement studies, however, are being actively conducted in each area to make the health program as effective as possible with the limited personnel available.

Individual service programs, including tuberculosis case finding through the use of mobile X-ray diagnostic units, BCG vaccination in the control of tuberculosis, topical application of fluoride among preschool and school-child age groups as a dental caries preventative, and blood surveys for the detection of syphilis, have been actively carried out to the extent possible with the funds and personnel that have been available. To stress the importance of these services, program planning in the various areas has been given high priority and has involved detailed inspections by area supervisory personnel, the assessment of community needs and facilities, and the priority to be given the several component parts of the program.

Hospital Care

As of June 30 the Bureau was operating 62 hospitals, ranging in size from 15 to 420 beds. At Mount Edgecumbe, Alaska, 420 beds are now available. An additional floor has been opened for tuberculosis patients at Tacoma. The 100-bed addition to the Montana State Sanatorium for Indians is under construction and should be in service early in 1952. Plans for a 200-bed general hospital at Albuquerque, N. M., under management by Bernalillo County, have been drawn. When completed, this hospital will provide for 80 Indians. At Anchorage, Alaska, a 400-bed hospital is under construction. A medical center, staffed by specialists in medicine and surgery, has been established to care for referred cases at Pine Ridge. S. D., and will be staffed by four physicians, one of whom is a qualified surgeon. A full-time dentist will also be located at Pine Ridge.

During the year the hospital at Bethel, Alaska, was destroyed by fire. An emergency appropriation was made by Congress for its replacement. Plans have been drawn and purchases are being made for beginning construction during the fiscal year 1952.

During the past several years the turn-over in personnel has been great and recruitment has been particularly difficult. The past year has been no exception. The Armed Forces and foreign-aid programs have taken some of the Bureau's experienced personnel while others have resigned to enter private practice or to accept more remunerative positions with other agencies. At the year's end 125 clinical medical officers were on duty in Indian hospitals, of whom 88 were full-time employees of the Bureau appointed through civil service. Thirty-seven were on detail from the Public Health Service for periods varying from 24 to 28 months. To fully staff all Indian Service hospitals and provide for needed specialized professional personnel, including ophthalmologists, pediatricians, and public health administrators, about 250 physicians are needed—40 for field service and 210 for hospital duty.

Many of the hospitals are operating with only one full-time physician. Two hospitals are operating without full-time medical officers, the medical service being furnished entirely by local practitioners on a part-time basis. Supervisory medical service is rendered by 13 medical officers in the central and area offices, 7 of whom are on detail from the Public Health Service. Progress has been made in developing arrangements with local practitioners and nearby hospitals for health services to Indians on a contractual basis. For example, at Fort Berthold, N. D., where the site of the present Indian Service hospital will be submerged as a result of the construction of the Garrison Dam, plans have been completed for service to Indians at nearby hospitals.

Dental Services

During the year material progress has been made in the expansion of the dental program for Indians. The chief dental officer, assigned to the Bureau from Public Health Service in November 1950, was, after 2 months in the central office, reassigned in February with headquarters in Denver, Colo., where he could operate from a point centrally located with reference to the Indians who reside in the western part of the United States. Since his assignment to Denver he has visited 46 Indian Service installations (hospitals and agencies) for the purpose of reviewing caries conditions among Indian children, evaluating dental care and prophylactic measures, and planning an expansion of the dental program within the limits of funds available.

These visits have been made in 8 of the 11 administrative areas of the Bureau. Also, during the month of May a service-wide inventory of dental material (equipment on hand and needed) was accomplished with 90 percent of the Bureau installations reporting. Following this inventory a great deal of needed dental equipment and supplies were obtained, much of which was transferred to Indian installations as surplus property from other Government agencies. Of 37 dental officer positions allowed under 1951 budgetary limitations, 35 dental officers are now on duty and 2 are on orders to report for duty, 1 in the month of July and 1 in September. Of the 35 dental officers on duty at the close of the fiscal year, 12 were assigned during the year from the Public Health Service for military service periods (18 to 24 months) and 5 have been recruited during the year for full-time employment under civil-service status.

Nursing Service

Because of the Nation-wide shortage of nurses, the Bureau of Indian Affairs has found it difficult to obtain an adequate number of nurses to properly staff its hospitals. As the demand for nurses by the military services and by other agencies has increased, the maintenance of adequate nursing service for Indian Service hospitals has become increasingly acute. While a considerable number of nurses has been lost to the military services, other equally important factors—such as remoteness of stations, long hours of work, and lack of educational, social, and recreational activities—played a major role in the loss of personnel in this critical category.

As compared to last year, there has been a loss of 45 in the actual number of nurses on duty, but there is a total increase of 60 positions unfilled. This difference is due to 15 new nurse positions allowed in the 1951 budget for the Tacoma Hospital and Alaska to take care of the additional patient load.

Much time and effort have been spent in nurse recruitment. Various nursing schools were visited and talks given to senior students. Brochures on nursing opportunities in the Bureau have been distributed to some 700 hospitals with schools of nursing. Enrollment of students at the Bureau's Kiowa School of Practical Nursing (in existence since 1935) has been increased and the course lengthened from 9 to 12 months. Limited hospital and housing facilities at the school make it necessary to admit two classes yearly in order to accommodate all students.

A consultant in nursing has been added to the staff and is assigned to the Window Rock area. An additional consultant in nursing will report for duty in the area office in Phoenix in September.

A survey has been made of the nursing resources in Alaska in contemplation of a school of practical nursing at Mount Edgecumbe. Tentative plans have been developed for the program.

Sanitation Activities

The greater part of the activities of the sanitary engineer has been concerned with efforts to promote expansion of sanitary services at Indian areas on the part of State and local public health units. Sanitary surveys were conducted at 31 reservations and agencies in 16 States, comprising about 70 percent of the reservation population in continental United States. This is the first time in the history of the Indian Service that such surveys were undertaken on this scale. Factual data were gathered on the incidence of communicable diseases conventionally attributed to faulty environment and the level of sanitation in general. The reports and recommendations submitted have been supplemented in most instances with color photographs.

Contact has been maintained with State and some local health departments in the interest of determining the extent of financial assistance that may be necessary to permit State and local units to extend to the Indian population sanitation services commensurate with those now rendered to non-Indians within the general areas. This has particular reference to public health education, including demonstration of sanitary facility development.

State health department codes of rules, regulations, and requirements have been secured from each 1 of the 26 States having any registered Indian population. This is in anticipation of ultimate adoption of such codes by tribal action at various reservations in order that they may apply equally to reservation and nonreservation areas.

Arrangements have been completed with the Training Division, Communicable Disease Center, United States Public Health Service, Atlanta, Ga., for a 6-week or 3-month course of training in general and environmental sanitation for a group of selected Indians. This course will be conducted on any Indian reservation designated by the Bureau, and at various times during fiscal year 1952. As many as 20 trainees will be accepted for the initial course of training.

Tuberculosis Control

Hospital utilization within budgetary limitations continues near capacity. Reports regarding the use of the newer antibiotics in the treatment of selected (early) cases of tuberculosis indicate that healing processes are accelerated. This fact emphasized the greater need for early diagnosis and prompt treatment. Three Bureau mobile X-ray units continued operation in case-finding procedures. A total of 23,169 Indians were examined during the past year. During the summer months three additional units were on loan from the Public Health Service.

The number of beds available for treatment is inadequate. During April a survey of all State, County, and privately owned sanatoria in the Western States in which Indian reservations are located, indicated that at least 400 beds are available for treatment of Indians in nongovernmental facilities. Funds to hospitalize patients in these facilities are not available.

A BCG demonstration program for the benefit of State and County health personnel was arranged for Oklahoma in Caddo County. A service-wide vaccination program for the newborn is being developed for fiscal year 1952. This is made possible by the development of BCG vaccine, the viability of which, is reported to be for 30 days. Thus the Bureau will be able to supply vaccine to isolated hospitals for use in vaccinating all children delivered in hospitals at the time of birth. This will be a continuing program and will be supplemented by school-age programs, eventually covering the entire Indian youth population.

An evaluation of the original BCG vaccination program, now in its fourteenth year, is being conducted. The results, as shown by preliminary examination of the records, are encouraging. BCG offers a practical means of supplementing the control program, which is inadequate from the standpoint of hospitalization and isolation facilities. Considerable assistance in hospitalizing tuberculous Indians is being given the Bureau by states, especially in the northern areas.

A chest X-ray survey of Indians living on reservations in Arizona and Nevada was conducted during the year. Over 11,000 X-rays were taken, indicating a large percentage of Indians cooperating in the survey. Summaries prepared covering 10,427 of the X-rays show 292 active tuberculosis cases, 252 tuberculosis suspects, and 2,187 healed primary tuberculosis cases.

In November 1950 a complete serologic survey was made of the Havasupai tribe, most of whom live in a remote canyon in Arizona near the Grand Canyon. The entire population of the village, except two who were away on business, was covered by the survey. The high degree of cooperation shown by the Havasupais and their eagerness to avail themselves of modern medical services were most impressive.

During the fiscal year 1951 a contract for health services was entered into with the State of Nevada for Indians under the Carson and Western Shoshone agencies. This contract provides for public health services to Indians the same as those rendered to other citizens of the State, and for 28 Indian clinics. It has proved extremely beneficial to the Indians, and is an important step in bringing the Indians of Nevada into the normal life of the State.

EDUCATION

The Branch of Education is charged with the responsibility of developing comprehensive long-range educational plans to meet the needs of the Indians within the continental United States and Alaska and to prepare them to take their places on a basis of equality with their non-Indian neighbors.

In many areas where Indians live no public schools are available; therefore, it is necessary for the Bureau to provide school facilities for these children. The Bureau operates reservation and nonreservation boarding schools for Indian children requiring institutional care, and day schools for those who live in isolated communities where there are no public schools. More than half of the Indian children in school at the present time are attending public schools. The transition from Indian schools to public schools is, of necessity, a gradual process.

For the fiscal year 1951, the Bureau of Indian Affairs continued contracts under the Johnson-O'Malley Act with 13 State Departments of Education and negotiated 1 new contract for the education of Indian children. Such contracts are now in effect in the following states: Arizona, California, Idaho, Minnesota, Montana, Nebraska, Nevada, North Dakota, Oklahoma, Oregon, South Dakota, Texas, Washington, and Wisconsin. The State of South Dakota was added to the list over the previous fiscal year. Other contracts will be negotiated for the transfer of Indian pupils to local public schools when the children are able to adapt themselves to the public school environment and the public schools are open to them.

The Bureau also negotiated contracts with state and private institutions for education and care for the deaf, dumb, blind, mentally deficient, and physically handicapped Indian children.

During the fiscal year 1951 the Bureau of Indian Affairs operated 89 boarding schools and 140 day schools within the continental United States, and 3 boarding and 93 day schools in Alaska.

The Bureau is now in the process of reclassifying professional education positions based upon the class specifications issued by the Civil Service Commission in April 1949. This action will generally raise salaries of education personnel to the point where the Bureau can compete somewhat with the salary schedule of the public school system. This, in turn, will make recruiting of a higher type of personnel possible, will hold outstanding personnel in the service, and will increase the efficiency and effectiveness of the education program.

A research specialist has been added to the branch of education who will make an analysis of the curricula and course content, including the state courses of study which are now in use in the Indian Service schools. These findings will determine what the course content and curricula should be, in order to strengthen the existing program. He also will make a study of the vocational and high-school graduates at the Pine Ridge agency in South Dakota, covering the past 10 years in order to evaluate the impact that the educational program at that agency has had upon the students and the Indian communities served by these schools.

A specialist in guidance and loans has been appointed to a position in the branch of education to help outstanding students who desire to further their training in colleges and universities.

Of the estimated 103,970 Indian children of school age, approximately 33,300 are in Federal boarding and day schools; 36,215 are in public schools; 8,000 are in mission and private schools; and 18,400 not in any school.

In Alaska, an estimated 5,400 are in Federal schools, 3,700 are in Territorial schools, 600 in mission schools, and 1,400 not in any school.

Promoting Navajo Education

When the plight of the Navajo Indians was brought to the attention of the general public in 1946, there were approximately 5,000 school seats for almost 24,000 Navajo children of school age. Practically all of these seats were occupied by elementary children below the age of 12. Of the more than 10,000 children between the ages of 12 and 18, fewer than 500 were attending high schools of any kind. The great proportion of the remainder were either without any educational experience or with such limited educational experience as to have difficulty in securing employment away from the reservation.

With aroused Congressional concern over the education of Navajos, steps were taken to increase the enrollment of younger children on the reservation, to provide opportunity for the education of older children in off-reservation Federal schools, and to increase the reservation school facilities. Even these proposals, if carried to completion, would provide educational facilities for little more than half the school-age population on the reservation.

In the 5 years which have elapsed, progress has been made in all three directions with the result that today some 12,000 Navajo children are enrolled in schools of all kinds, Federal, public, and mission, with the great majority—in excess of 10,000—enrolled in Federal schools.

Of the children enrolled in Federal schools, the most spectacular progress has been made with some 4,200 children, beyond the age of 12 years and with little or no schooling, who have been enrolled in off-reservation Federal boarding schools for a speedup course of 5 years designed to equip them with the ability to speak English and the vocational skills to secure and hold permanent employment away from their home reservation.

Funds and facilities to care for these older children have progressively increased during the 5 years from the first 291 who registered at Sherman Institute in 1946 to a total enrollment this year of 4,200 in all schools. These older illiterates have been enrolled in eight schools: One in Oregon, one in California, one in Nevada, one in Arizona, one in New Mexico, two in Oklahoma, and the last and largest in Utah. In 6 of the schools enrolling from 48 to 250 Navajos, these students represent a minority of the entire student body. Of the remaining 2, Sherman Institute in California enrolls 600 Navajos to 150 Papagos; and Intermountain Indian School at Brigham City, Utah, enrolled 1,300 Navajos this year, and next year will increase this enrollment to 1,850 Navajos with 150 Papagos rounding out the total capacity of the school. In addition, there are 2 other Oklahoma schools enrolling between them 100 Navajo high school students in the regular high-school program of these institutions.

This program is significant, because for many years the great bulk of Navajos actively resisted the acquisition of the English language as well as any formal education. When it was originally proposed that a speed-up program of educating adolescent Navajos within a period of 5 years would be productive, it was severely criticized by a majority of the educators both inside and outside of the Indian Service who have previously dealt with the Navajo problem. However, George Boyce, at that time director of education on the Navajo, and Mrs. Hildegard Thompson, who had for a number of years been an elementary supervisor on the Navajo Reservation, agreed with director of education, Willard W. Beatty, that such a program, properly taught, could be productive of intensive learning.

The initial program provided for 3 years of intensive emphasis on general academic work with an hour to an hour and one-half daily experience in the use of tools. The vocational experience was broadened during the fourth year to half-time in specialized vocational instruction, and in the fifth year, to a minimum of three-quarter time specialized vocational instruction with some continuing emphasis on the reading, writing, and speaking of English language.

It was the firm conviction of the leaders of this special program that the greatest speed in the acquisition of English and in the comprehension of the cultural, as well as intellectual, adaptations to non-Indian life could best be achieved when there was thorough comprehension by the students of every step being taken from entry to school until graduation.

In order to economize on time, much instruction during the first 6 months that the child is in school takes place in the Navajo language. What is expected of the student with regard to wearing apparel, home living in the dormitories of the off-reservation schools, the acquisition of table manners and other culture patterns of the majority culture are carefully taught in the Navajo language. It was also noted that much of the work in basic arithmetic lent itself equally well to instruction in Navajo as in English.

To the extent that they were available, these schools were staffed with college-educated Navajos, of whom there were only a few. In the remainder of the classes, the most competent available elementary teachers were teamed with a competent English- and Navajo-speaking high-school graduate who became a teacher-interpreter. Each day the lesson plan of the day following was carefully worked out between the expert teacher and the teacher-interpreter so that each step of the lesson could be of maximum help to the students on the following day.

During this first 6 months, considerable emphasis is placed upon learning English as a separate and foreign language. The success of the teacher-interpreter and of the straight English teaching has been such that with the beginning of the second 6 months it has proved possible to carry on much of the classroom instruction in English and Navajo, and in the second year, English becomes the basic language of classroom instruction. This, however, does not dispense with the services of the teacher-interpreter, for it has been found a basic economy for the teacher-interpreter to remain active during the second year to see that nothing which takes place within the classroom shall escape full understanding on the part of the students. When there is the slightest doubt as to the meaning of an English word or phrase or any confusion, the student can immediately request a careful translation into Navajo so that he is fully cognizant of exactly what is taking place in the classroom.

As a result of this intensive instruction, the class medians have recorded an achievement of 2½ to 3½ years of progress during the first year.

The rate of progress has gradually decreased as the students have advanced and as the academic accomplishment has more nearly approximated that of their chronological age. It has been found that as a result of the instruction offered, non-English-speaking beginners show a capacity to know and use about 330 words out of some 500 used in instruction and common intercourse. It is believed that at the end of the second year, this capacity has increased to approximately 1,000 words.

All of the pupils have been encouraged to seek and engage in Saturday employment, and after the first summer when the children are encouraged to return to the reservation, an effort has been made to find employment during the summer months for the children engaged in this off-reservation program.

During the fourth year, some effort has been made to secure opportunities for on-the-job training in various types of activity in the area in which the school is located.

During the fifth year, that attempt extends to an effort to place all of the fifth-year students in on-the-job training away from the campus for at least half of the school year.

Sherman Institute at Riverside, Calif., the first school to enroll Navajos in the off-reservation special program, brought the remaining members of its first-year class to graduation in May of 1951. One hundred and one students completed the course after almost 80 percent of the students had enjoyed on-the-job training experiences away from the campus during the closing year. As a result of the training offered by Sherman Institute, every one of these completing students were offered permanent employment at the conclusion of the course. A number of the boys were not able to accept permanent employment, because they were called into the military service under Selective Service. However, all the girls were placed, and all the boys who were available to accept full-time employment.

The boys found placement with cabinet makers, sash and door manufacturers, glaziers, manufacturers of building hardware, plant nursery men, painters, bakers, poultrymen, and in restaurants as cooks and helpers.

The girls found employment in day nurseries, drapery shops, private homes, motels, restaurants, and hotels. A dozen of these students have accepted permanent paid employment on the reservation as cooks, day school housekeepers, dining room attendants, and in similar jobs.

All of the students received payment for on-the-job training; the boys wages ranging from $0.75 an hour to $1.50, and the girls wages from $7.50 to $22.50 per week, room and board included.

All of the students engaged in on-the-job training have lived away from the campus, and have either received room and board as part payment for their services or have paid for their room and board out of the compensation received.

Employers near the Los Angeles area have been found to be entirely receptive to these Navajo students, and little difficulty has been found in placing them.

At Phoenix Indian School in Arizona, on-the-job training has been tried with a number of fourth-year students, and has been similarly successful despite the fact that the initial reaction of many employers was averse to employing Indians. The result of this has been that most of the on-the-job training at Phoenix has been done without compensation, but has, in the majority of cases, led toward permanent employment with the same firms and has opened the way for further employment of Indians in the area.

At Santa Fe and at Albuquerque, the concern displayed in the on-the-job training and placement of the Navajo students has been extended to the non-Navajo attending these two schools and has been equally successful in finding them satisfactory placement. Again, of course, the draft law has interfered with the employment of a large number of the boys completing their high-school course.

The success of these placement efforts carried on at the Bureau's southwestern schools is resulting in more concrete plans for similar placement of the students of the northern schools where the students do not successfully find employment for themselves.

On the Navajo Reservation, further progress is being made in the construction of dormitories in the new Shiprock School project, and the reconstructed Tohatchi School was opened for occupancy for 120 children in early January.

Funds were received to provide for the construction of dormitory facilities in connection with the Thoreau School on the Navajo Reservation, which will provide space for an additional 120 children.

Funds are also available for the construction of dormitories at Hunters Point and at Cheechilgeetho, which will regularize the boarding school operation at these two plants.

Further steps toward the erection of dormitory facilities at others of the old day schools have been delayed somewhat by a decreased rate of appropriation growing out of the Korean emergency.

There has been a follow-up study on the general achievements of Indian pupils in Federal, public and mission schools at the fourth-, eighth-, and twelfth-year levels to correlate with the result obtained by Dr. Shailer Peterson of the University of Chicago in a study in 1946.

Plans are being made for a similar study of the effectiveness of high school education for Indians in Federal and public schools of Oklahoma during the fiscal year 1952.

CREDIT AND EXTENSION WORK

During the fiscal year 1951 Indians continued to maintain their good credit record on loans from the revolving fund. Because of the revolving nature of the fund, which makes payments of principal and interest available for further financing, loans totaling over $16,400,000 have been made from the $8,350,000 appropriated for loans, and over $500,000 remained available for additional loans. Repayments of more than $8,200,000 were made on principal, and over $440,000 interest was paid. The unpaid balance was about $8,200,000.

On these loans of over $16,400,000, losses totaling $31,700 have been suffered, or 0.2 percent. Payments of more than $8,670,000 were due on these loans, of which nearly 97 percent was paid, 2 percent extended, and about 1 percent was either delinquent or uncollectible.

Indian tribes are now using more than $4,200,000 of their own funds in their credit operations, to supplement funds borrowed from the revolving credit fund.

In addition to the more than $12,400,000 of revolving credit and tribal funds being used for loans, about 42,000 head of cattle which originated in purchases from emergency funds for drouth relief in the 1930's are under contract to Indians on a repayment-in-kind basis. These cattle, which would have gone to slaughter had they not been made available to the Indians for the purpose of establishing foundation herds for them, represent an asset on the present market of more than $4,000,000. The act of May 24, 1950 (64 Stat. 190) authorizes cash settlements of "in kind" indebtedness, the sale of livestock repaid to the United States, and deposit of the proceeds in the revolving credit fund. Loans of livestock are gradually being converted to cash.

Three different types of loans are made: business enterprises of tribes, cooperative associations, and individual Indians. As examples of business enterprises of tribes, four salmon canneries in Alaska are being operated with loans. A fifth cannery is now being operated entirely with tribal funds, supplemented with loans obtained from banks. About 32 percent of the total amount loaned has been to finance such enterprises.

As examples of cooperative associations, the development and marketing of Indian arts and crafts products are being fostered by the Northern Plains Arts and Crafts Association at Browning, Mont., and the Southern Plains Arts and Crafts Association at Anadarko, Okla., both of which have received loans. About 5 percent of the total amount loaned has been to finance cooperatives.

Individual Indians receive loans for any purpose which will help them to become self-supporting, including loans for educational purposes. About 63 percent of the total amount loaned has been used to finance individual Indians. More than 21,200 loans have been made to about 11,400 different Indians.

As a result of these loans and the supervision and assistance of Indian Service extension workers, it is estimated that about 4,900 of these borrowers are now self-supporting.

Loans from the revolving fund are made to Indians unable to obtain financing elsewhere and consequently involve a high risk element. Efforts are made to reduce risk by careful planning and supervision of loans. As soon as borrowers reach a point in their economic development where they are in a position to obtain financing from the same sources serving other citizens and institutions in the area, they are encouraged to do so. As an example of the progress being made along this line, the Hydaburg Cooperative Association in Alaska received loans from the Bureau for the construction and operation of a salmon cannery. The construction loan has been repaid, and the plant is now appraised in excess of $400,000. In 1950 a loan of $300,000 from the revolving fund was required to operate the cannery. As a result of successful operations in 1950, the association will be able to finance part of its 1951 operations with its own funds. It also has been successful in making arrangements with a bank to supply financing up to $100,000. The operating loan from the revolving fund for 1951 has been reduced to $150,000. It is hoped that within the next few years, the Government will be able to withdraw entirely from financing the operations of this cannery. Similar procedures are being followed with other borrowers from the revolving fund.

Despite a decrease in the number of Indian families engaged in farming and stock-raising activities during the past calendar year, total agricultural income received by Indians increased from $48,000,000 in 1949 to $49,600,000 in 1950. Income from livestock activities alone increased over $2,000,000. Part of this increase was due to the record high prices received for beef cattle; many reservations reported receiving the highest prices for livestock in their history. The increased livestock income was not due solely to the high prices, however. Improved quality of Indian-owned cattle and improved marketing procedures were also reflected in the increase.

Indian stockmen at a number of agencies have established a reputation for the high quality of their stock, and their sales attract more cattle buyers each year. At the Standing Rock agency in North Dakota, the San Carlos agency in Arizona, the Mescalero agency in New Mexico, and the Colville agency in Washington, Indian stockmen have made outstanding progress in the beef cattle industry. An unfavorable factor in the beef cattle activities among the Indians was the overselling of breeding stock. Many sold below the minimum numbers necessary for an economic unit, chiefly because of high prices but also to meet the rising cost of living.

The extension program provides for continued emphasis on the keeping of dairy cows to supply milk for family needs. There was a 5-percent increase in dairy cattle numbers during the year. There was a somewhat smaller increase in the numbers of hogs raised by Indian farm families; this project also is encouraged chiefly to provide for family food requirements.

Indian farmers harvested more acres of crops during 1950 than in 1949, although the total output was below that of the previous year. Income from crop sales decreased from $8,800,000 in 1949 to $7,600,000 in 1950. Total yields of forage crops were valued at $5,700,000. Total cereal grain yields were valued at $7,200,000. An increasing number of Indian farmers are following recommended practices of seeding and cultivation and are conducting their operations in accordance with approved soil-conservation methods.

Besides providing for their own needs the Indians have contributed much to the Nation's food supply. Emphasis is being placed on increasing their food production to aid in the defense program. It is believed they will respond wholeheartedly to this need as they did during the years of World War II, when they made a remarkable contribution to national needs both in manpower and agricultural production.

Home Extension Program

Improvement of the economic and social well-being of the Indians is carried on by Indian Service home extension agents. They work mainly with the family unit, particularly the women, but most of them devote at least a third of their time to conducting 4–H and similar work with girls. The program, similar in many ways to the long-established home extension work of the Department of Agriculture, includes efforts to increase Indian farm income through application of science and farm machinery; improvement of family living through more adequate housing, rural electrifications and home equipment; and development of a better understanding of community, county, State, and national affairs.

There are presently 13 field home extension agents in Oklahoma, New Mexico, Arizona, and Nevada. Five new positions were added during the year at Navajo, Colo., and Fort Berthold agencies. During the past fiscal year, the agents spent a total of 1,967 days in the field in visits to 2,742 homes, where some 4,500 improved home practices were put into effect. They organized 118 clubs with 1,667 members. There are about 4,000 Indian 4–H club members.

Arts and Crafts

The Indian Arts and Crafts Board has the responsibility of stimulating and organizing production and marketing agencies, improving quality and standards, and assisting in establishing marketing outlets for Indian arts and crafts organizations.

In general, there is a noticeable increase of interest in arts and crafts, not only in this country but in other countries as well; and many of these other countries have become interested in the arts and crafts program which is being carried on among the American Indians, with the idea of developing arts and crafts in their own countries. There is also evidence that the young Indian people of today are becoming more interested in arts and crafts.

The supplemental income derived from arts and crafts means a great deal to the Indian people, and in many instances the income from this source is greatest among the poorest and neediest Indians. In some areas this represents practically the only cash income they receive; and potentially, arts and crafts, together with manual industries, constitute one of the most promising sources of income available to them.

The modern dress project begun by the Oklahoma Inter-Tribal Crafts Association 3 years ago is now a thriving business. Here styles and designs of traditional Indian costumes of the Southern Plains Indians are adapted to dresses and accessories for modern wear. Most of the marketing outlets so far have been established in resort cities in the western part of the country, but there is a potential outlet in the East also. Until a few months ago, the big problem was production but recent reports from the association indicate that production has increased and orders are now being filled promptly.

In the Aberdeen, S. Dak., area, interest in arts and crafts is increasing; and the Board has made arrangements to assign a full-time arts and crafts specialist to this area to assist in the craft programs in the schools and to help the adult groups with their craft problems. A manager-instructor in the fields of both ceramics and hand-weaving will be employed for this area, and it is expected that a full-scale program will get under way in the very near future.

Other areas, namely, the Minneapolis area and the Alaska area, have requested assistance from the Board in their craft work, and the greatest difficulty at the present time is lack of personnel to assist the groups who wish to expand their craft activities.

The Qualla Cooperative of the Cherokees of western North Carolina has had a successful year. In addition to their craft shop, which carries only high quality Cherokee crafts, they have a tourist project which includes a motor court, a dining lodge, and a filling station.

It is the plan of the Board to assign an arts and crafts specialist to the eastern area which will include the North Carolina Cherokee group, the Seminoles in Florida, and the Choctaws in Mississippi. The Seminoles have an excellent craft program, but they need assistance in stepping up their production and in finding new markets. At one time some of the finest baskets came from the Choctaw group in Mississippi, but interest in crafts has dwindled in this area. With the help of an arts and crafts specialist, it is hoped that the Choctaw people will rekindle their interest in arts and crafts.

It appears increasingly evident that the public is becoming aware that many new and useful arts and crafts items are being made which, while keeping closely to the Indian tradition, are being styled and designed to meet demands of modern interior decoration and modern dress. The modern dresses which are now being made by Indian craftsmen in Oklahoma show how well traditional Indian styles and designs may be adapted to clothing, and this is also true of the many other arts and crafts now being produced by Indian craftsmen throughout the United States and Alaska.

RESOURCES: LAND AND WATER

Inflated land values brought on by the high prices being paid for farm products and livestock, coupled with the ability of many more individuals to invest in real property have created a ready market for Indian-owned land. This rising demand for land by non-Indians and the high prices being paid have resulted in a large number of Indians requesting supervised sales of their lands and the removal of restrictions or trust so that they may dispose of their holdings. As a result, transfer of Indian-owned lands to non-Indians has continued at a rapid rate.

To facilitate and expedite conveyances and adjustment transactions affecting Indian-owned lands the Commissioner delegated additional authorities to the directors of the several area offices. These new authorities contained in order No. 551, issued March 29, 1951, pertain to the approval of transactions involving the removal of restrictions, issuance of patents in fee, and sales of Indian lands. Immediately after the order was issued and a manual of procedures furnished area officials, they began exercising the authorities delegated. Since the delegation of authority, the area directors have approved deeds covering sales and requests for the issuance of patents covering a total area of approximately 14,300 acres of land.

Land transactions approved by the central office prior to the delegation of authority involved the issuance of 316 patents in fee totaling 50,350 acres, and sales covering 41,048 acres, for a total consideration of approximately $790,000.

During the previous fiscal year a total of 605 patents-in-fee were issued comprising 96,555 acres, and 60 sales by deed covering 7,177 acres.

The heirship problem continues to be the most difficult and pressing of those confronting the Bureau in the field of land activities. Various tribes are joining the Bureau in an attempt to lessen the problems by reducing the amount of heirship land through purchase of undivided interests with tribal funds. However, there are not sufficient funds available to reduce substantially the area of such lands. The principal means of combating this problem is through the system of exchanges between individual Indians and the tribes. The progress of the land-adjustment programs was hampered considerably because the field personnel necessarily had to expend a considerable amount of time in processing the transactions relating to the conveyance of lands to non-Indians. However, officials of the area offices have approved a large number of transactions which have assisted in the consolidation of Indian lands and a reduction in the administrative problems relating to heirship lands. In connection with these activities, 2,700 deeds have been approved.

Minerals Exploration

Beginning a few years prior to Pearl Harbor, the Indian Service, in cooperation with other agencies of the Government and the Indian owners of the minerals, adopted a policy of more active encouragement of discovery, increased production and simplified procedure in making available the mineral deposits needed by the war industries—all accomplished within the framework of sound conservation principles. This policy has remained in effect.

The policy of encouraging exploration under prospecting permits has resulted in increased development. During the fiscal year ended June 30, 1950, approximately 2,000 oil and gas leases were approved. More than 20,000 barrels of oil were produced from slightly in excess of 11,000 producing wells on Indian lands. Gas production totaled more than 13 billion cubic feet. On the Osage Reservation, where it appears that the peak of production has passed, there is a strong interest in secondary recovery operations.

For many years the main source of Indian income from oil and gas leases has been obtained from Indian leases in Oklahoma. The orderly development and administration of the leases has resulted in profitable production from many old stripper wells. Here also there has been a renewed interest in secondary recovery and the reworking of old productive areas to find new producing sands and small pools.

As the result of prospecting operations carried on over a period of years under simplified prospecting permits issued locally the Jicarilla Reservation has since 1948 received approximately $1,500,000 in bonuses under oil and gas leases sold at competitive bidding.

At a sale held May 29, the bids received on 22,990 acres of Southern Ute tribal land amounted to $926,245.36. At the same sale the bids received on 19,520 acres of Ute Mountain tribal land amounted to $1,164,720.

The approval of the ore commingling plan on the Quapaw Reservation and the increased price for ore have served to increase the production of low-grade lead and zinc ores and isolated high-cost ores.

Since the first discovery of petroleum on the Navajo Reservation, around 1924, income from oil has totaled $3,747,306.36.

Other minerals from the Navajo lands play an important part in the defense effort. It is expected that the extensive diamond drilling program of the Geological Survey on the Navajo Reservation will serve to increase the output of carnotite ores.

The following table gives the Navajo income from vanadium-uranium, coal, and sand and gravel for the fiscal year ending June 30, 1950:

	Tribal land	Allotted land
Production royalties (vanadium-uranium)	$62,761.01	None.
Rentals on vanadium-uranium leases	2,044.90	None.
Production royalties (Indian coal mining permits)	950.01	None.
Sale of sand and gravel	328.67	None.
Total	66,084.59	

From 1942 to 1950, the total income from vanadium-uranium leases was $170,299.95. The development of the potential uranium resources on the Navajo Reservation has received continuous attention. Cooperation with the Atomic Energy Commission has been marked.

It is expected that the production of other useful materials from Indian reservations—such as tungsten, asbestos, gypsum, and sand and gravel will increase and play a part in the Nation's defense program. A new source of income for the Cheyenne and Arapaho Indians of Oklahoma and the increased production of an item which was in short supply during World War II may result from the proposed development of vast gypsum ($CaSO_4$) deposits in western Oklahoma in the area where the Cheyenne and Arapahoes were allotted lands.

The task of revising the 1928 roll of California Indians was given the Sacramento area office by the act of June 30, 1948. Despite an unforeseen delay of 7 months, enrollment work under the 1948 act is practically completed and work is now going forward on the tabulation of applications from those Indians denied enrollment in 1928 and the making of per capita payments from the judgment fund as provided by the act of May 24, 1950. As of June 26, 1951, per capita payments of $150, totaling $1,954,500, have been made to 13,030 Indians of California. Coincidental with the program, $25,000 have been collected from the Indians on debts owed the United States for reimbursable loans, probate fees and repayment cattle. It is estimated that it will take another year to complete the 1950 enrollment and pay the Indians on that roll.

The payments are being made in settlement of claims of about $5,000,000 growing out of the so-called 18 unratified treaties of 1849. The treaties with the California tribes were never ratified by the Congress because gold was discovered on the Indian lands in 1849.

Conserving Indian Soil and Water

Increased soil productivity is indispensable in the present emergency. During the past 10 years 8.9 percent of the soil conservation work needed on Indian lands has been completed. The program is not adequate, however, since erosion is making unfit for cultivation a daily average of 80 acres out of a total of 3,260,000 acres.

Recognition of the seriousness of land loss by Indians is shown by the money and work they have expended after learning the techniques of conservation. The Indian Bureau completed a $13,118,770 soil and water conservation job this year with a soil and moisture conservation appropriation of only $1,561,470, because Indians spent $7.50 for every dollar expended by the Bureau on work to preserve their soil and water resources. Indians have continuously increased their proportionate share of work, because they see on their own farms not only stoppage of soil losses but progressively increasing yields.

A survey of 17 reservations showed increased farm production of $27.15 for every dollar spent by the Bureau for soil-conservation purposes, and $3.68 for each dollar spent by the land user. Numerous examples of increased production from every section can be cited: At northern Idaho, wheat increased per acre, 50 bushels or 580 percent; at United Pueblos, oats increased 30 bushels an acre or 213 percent, and corn, 22 bushels or 70 percent; at Osage, wheat increased 275 percent, with an added $44.80 per acre for vetch seed.

Conservation education was accelerated during the year. The Branch of Education, in consultation with the soil conservationists, integrated soil-conservation instruction into the school curricula. On the Navajo and Hopi Reservations soil conservation was integrated into the curricula of all elementary schools and entire courses were prepared for the Fort Wingate and Hopi High Schools.

Participation in the Production and Marketing Administration program was increased with Navajos on allotted land being permitted to participate in the program for the first time this year. Users of range lands are now permitted to participate as family groups. Over $100,000 of PMA money was used by Navajos and Hopis this year.

Irrigation

On the Navajo Reservation in New Mexico 114,000 acres of class I and II lands are available for gravity irrigation development under the proposed Shiprock project. This acreage would be a large factor in creating economic stability in the area and would effect a substantial reduction in the Nation's responsibility to the Navajo and Hopi Indians. A comprehensive interim report was submitted covering several plans with cost studies for this important project. Water storage in a reservoir formed by the construction of the proposed Navajo Dam on the San Juan River would be the first major step in developing the project. The impounded water would be used primarily for irrigation, river control, and hydroelectric power generation. Final project reports and plans, however, must be deferred until allocations of water flowing in the San Juan River have been established. The prior water rights of the Indians to the river flows and the many demands placed on the short supply have produced varied and involved competition between the San Juan-Chama project for transmountain diversion to the Rio Grande Valley; the South San Juan project; and the Shiprock project. Nevertheless, substantial progress has been made during the fiscal year in clarifying conflicting claims and unifying efforts between the claimants. Determination of the San Juan River water allocations is anticipated in 1952.

In expanding the Colorado River Reservation irrigation project to its ultimate area of 100,000 acres of irrigated lands, 75,000 acres of which will be for the colonization of Indians from less productive reservations, 3,330 acres of land were completely subjugated with canal and drain construction during the fiscal year. Electric service for farm and domestic purposes was also supplied to the expanding colonized area by the extension and installation of transmission and distribution lines with necessary substation equipment.

Construction work continued during the fiscal year on the satus No. 3 unit of the Wapato irrigation project on the Yakima Indian Reservation, which, when completed, will add an additional 10,000 acres to the project area. Two pumping stations which will supply water to the area are scheduled for completion in fiscal year 1952.

Power construction on the Flathead irrigation project in Montana made service available to approximately 450 additional customers during the fiscal year. This work involved the construction and enlargement of approximately 35 miles of transmission and distribution lines. The irrigation system was extended to serve approximately 1,000 acres of new land and to provide supplemental water to 3,000 acres.

Forest and Range Management

Forest, range, and wildlife resources comprise the keystone in the economy of many of the larger Indian communities and of adjacent non-Indian communities, particularly in the West, and make material contribution to the national need for such products. Therefore, it is in the public as well as the Indians' interest to continue sustained yield management of their forest and range lands and to provide adequate protection against fire, insects, and disease.

During the calendar year 1950, the timber cut on Indian lands approximated 688,791,000 board feet, with a stumpage value of $6,067,847. Included in this volume is approximately 41,812,000 board feet produced by three Indian sawmill enterprises. The volume of timber cut is well within the sustained yield capacity of the forests. Funds are still inadequate for intensive forest management.

About 48,000,000 acres of Indian range lands provide forage for 620,000 cattle, 967,000 sheep, and 99,900 horses. During the past year the Indians used 36,700,000 acres of their range lands for grazing their livestock. In view of the importance of the livestock industry among the Indians and of conserving the fertility of the soil, it is essential that the range resources be managed properly. Management has been such that in general the forage has been utilized in accordance with the principles of conservation. In the Southwest, however, the prolonged drought and heavy grazing have created major problems in range management and the livestock industry among the Indians, particularly on lands under the jurisdiction of the Navajo and United Pueblos agencies.

The value of the 1950 harvest of fish and wildlife on Indian lands is estimated at $2,537,000. The fish taken by Indians had an estimated value of $1,171,000. In some areas these resources have an important part in the economy of the Indians.

On nearly 50,000,000 acres of Indian land under protection, it was necessary to suppress 904 fires during 1950. These fires covered 33,000 acres and caused damage estimated at $147,700. Lightning caused 54 percent of the fires. Fort Apache Reservation, Arizona, had 297 fires, approximately 33 percent of the total for the Service. Funds for detection, patrol, and initial suppression are still inadequate despite a steadily increasing hazard in the pine stands, which comprise major portions of Indian forests.

ROAD CONSTRUCTION AND MAINTENANCE

Preparation for national defense was a distinguishing feature of the Bureau's 1951 road program. Several investigations were made of proposed access roads to military establishments and sources of critical materials. The Bureau of Public Roads has requested the Indian Service to build these roads.

The Navajo-Hopi long-range program was started during 1951. While only one-half of the funds authorized were appropriated, the job of tooling up for the project was completed, and 51 miles of primary roads constructed.

During 1951 the Indian Service graded and drained 86 miles of road; 72 miles were gravel-surfaced; 22 miles of black top was laid; and the equivalent of twenty-two 50-foot span bridges were built. Road maintenance and repair was performed on 20,500 miles of roads.

Uranium ore deposits and Navajo-Hopi rehabilitation may speed up the construction of a 20 million dollar highway program on the vast Indian reservations of northeastern Arizona.

Congress is being urged to make funds available for completion of the roads in 4 years instead of 10. The money would be used to crisscross the now almost inaccessible Indian country with all-weather roads.

These would tie in with national highways which skirt the reservations on three sides and in some instances would become important connecting links between transcontinental routes.

They would provide access roads to uranium deposits, improve trade and travel facilities for the more than 60,000 Navajos and Hopis, and open up tourist travel to some of the most picturesque scenery in the United States, including the famed Monument Valley.

Expenditure of the funds already has been approved by Congress as part of the 88 million dollar Navajo-Hopi rehabilitation program. But only $960,000 actually has been appropriated to date.

Meanwhile, a master highway plan for the reservations has been drafted and approved by the Bureau of Indian Affairs and the Bureau of Public Roads. It calls for a primary road system of 636 miles at an average cost of $20,000 a mile; a secondary system of 633 miles to cost no more than $10,000 a mile; and 950 miles of unimproved roads at $1,000 a mile. The primary system would be surfaced with gravel.

A total of 336 Navajo and Hopi Indians were employed during the fiscal year 1951 in road building operations, with an average of 200 on the payroll. Of these 144 are in supervisory or skilled positions. The Navajos and Hopis thus employed have received an average of $12,000–$13,000 per month as a group.

PLACEMENT

On most Indian reservations the land resources are insufficient either in quantity or quality to support the present population. Population is increasing much faster than the national rate, industrial development is negligible, and a large portion of the inhabitants face the alternative of remaining wholly or partially unemployed or of leaving home to seek employment. In a study of 16 reservation areas where the problem is considered most serious, it is estimated that resources available within the reservation can support only 46 percent of the reservation population even at a minimum standard of subsistence. To attain a fully adequate standard of living comparable to that of the national average, it is probable that more than half of all Indians would have to seek their livelihood off reservation.

The objectives of the Bureau placement program are to make known to Indians the opportunities existing for permanent off-reservation work and living, to assist those who are interested in improving their lot to plan for and successfully carry out their movement to places of greater opportunity, to ensure their acceptance in employment, and to facilitate their social adjustment in communities to which they may go. Placement in the limited sense of completion of the hiring process is, by formal agreements entered into during the past year, the function of the United States Employment Service, State employment services and of the Railroad Retirement Board. Preference is given in recruitment to employment in industries essential to the national defense.

A placement program to facilitate employment of Indians was begun with the Navajo and Hopi tribes early in 1948 and was introduced on a skeletal basis in five additional areas—Aberdeen, Billings, Minneapolis, Muskogee, and Portland—during the early part of 1950, and into Alaska in February 1951.

Except for Navajo-Hopi in the Window Rock Area, the placement staff has consisted of only one or two placement officers in each extensive and diverse geographical area and has served to lay a groundwork and to point to the need for more intensive and well-rounded services rather than to accomplish large numbers of permanent placements. For the Navajo and Hopi, the staff has been adequate to work closely with Indians in the various districts on their reservations and one placement officer has been assigned to each of four cities: Los Angeles, Phoenix, Denver and Salt Lake City, to assist workers to make adjustment when taking jobs in California, Arizona, Colorado, and Utah.

The placement staff has worked with Indian organizations, Indian leaders, and individual Indians to stimulate interest in employment, educate them regarding working and living conditions off the reservation, and assist them to use established employment agencies. The staff has worked with employers, employer groups, community welfare, civic and religious organizations, and other interested agencies to promote acceptance of Indians as employees and as community residents. The staff has assisted employment agencies and employers to recruit workers, and has secured cooperation of State employment agencies in extending special services to Indians. Traveling registration offices were established by State employment agencies in several States and State agencies have undertaken aptitude testing, vocational counseling, and guidance in Indian schools.

The placement staff participated in more than 20,000 placements during the 1951 fiscal year. Two-thirds of these placements were Navajo and Hopi for whom staffing both on and off the reservation was reasonably adequate. Over 90 percent were seasonal farm and railroad jobs because this work is most available in and near Indian country and because most Indian workers are unskilled. Seasonal employment has introduced many Indians to off-reservation life and work and will prepare them for the goal of steady, year-round employment. Smaller but significant numbers of Indians are already being placed in more permanent jobs. Navajos, for instance, now form the bulk of the common labor supply at the ordnance depots at Barstow, Calif.; Bellemont, Ariz.; Fort Wingate, N. Mex.; and Tooele, Utah, with more than 1,000 Navajo and Hopi now employed in these essential Army installations.

It is conservatively estimated that Navajo and Hopi earned approximately $12,000,000 during the calendar year 1950 in off-reservation employment, or approximately half their total income from all sources. Of this total income resulting from off-reservation employment, approximately $1,250,000 was received from railroad unemployment compensation.

WELFARE ACTIVITIES

Under the welfare program, the general assistance case load decreased to about 6,500 cases during the fiscal year 1951, as compared with 8,755 for 1950, because of the mild winter in the North Central States. With the resultant reduction in case load, as well as a larger appropriation for general assistance, it was possible to provide more adequate monthly grants to cover subsistence needs.

Social services were extended to more children in need of foster home placement, particularly to Alaska native children, many of whose parents entered sanatoria for treatment of tuberculosis. The monthly average of children placed in foster homes totaled 432, with 230 of that number accounted for in the Alaska program.

A growing awareness of social conditions on the part of the tribes is reflected in their requests that provision be made for additional social workers to be placed on the reservations to assist Indian families in working out plans to meet social problems.

TRIBAL SELF-GOVERNMENT

Indian tribes, whether they operate under unwritten custom or under constitutions, bylaws, and corporate charters adopted in accordance with one of the three organization acts (Indian Reorganization Act of 1934, the Oklahoma Indian Welfare Act, or the Alaska Act) have made measurable progress during the past fiscal year. Individual tribes have adopted rules governing membership in the tribe, the use and disposition of property, the expenditure of funds, the enforcement of law and order procedures, and other matters. Also, as they have gained experience in operating under their tribal governments, the tribes have found it necessary to amend their written documents and to consider the advisability of substituting written forms for unwritten custom.

The Navajo Tribe of Arizona and New Mexico exhibited an increasing interest in the budgeting of tribal funds to assist tribal members in stockraising and resource development. By action of the Navajo Council, over 2 million dollars was appropriated for loan and investment purposes, emergency drought relief, fire suppression, and similar purposes.

The Navajos demonstrated a highly developed civic sense in the quadrennial election of tribal officers held in March 1951. The usual printed election ballot proved unsuitable because of the high illiteracy—80 percent cannot read or write English and fewer still use the new written Navajo language developed by the Indian Service. It was only until quite recent years that the Navajos have overcome their active resistance to education of any kind.

Nevertheless, they resolved not to let the language barrier stand in the way of local self-government. They solved their electoral problem by using the photographs of the contestants for the various offices on the ballot. Here, too, the election committee had to overcome the traditional resistance of the Navajos to having their photographs made, and a few of the pictures had to be omitted. More than 75 percent of the 16,000 registered voters cast ballots at 74 polling places scattered around the vast Navajo Reservation. Some voters traveled as far as 60 miles by wagon and horseback over rugged trails to reach a polling place.

Planning by Tribal Groups

The Tribal Business Council of the Three Affiliated Tribes of the Fort Berthold Indians in North Dakota, who are faced with the immediate loss of 155,000 acres of their productive bottom lands for the construction of the Garrison Dam and Reservoir, completed plans for the use of the $7,500,000 made available to them by Public Law 437, Eighty-first Congress. This sum was in addition to an appropriation of $5,105,625 authorized in the same public law as compensation for the taking of tribal and individual lands. After long consultation among the tribal members, the Tribal Business Council created a revolving loan fund of $2,500,000 for the rehabilitation of tribal members, authorized a per capita payment of $1,000 to each tribal member as immediate aid, and established a reserve fund to remain to their credit in the United States Treasury. The council further authorized the use of any part of the $7,500,000 to pay any tribal member, who requested it, full payment of his pro rata share of tribal assets in return for the relinquishment by the member, his heirs and assigns, of all claims to any future tribal rights, income, and assets.

The Uintah and Ouray (Ute) Indians of Utah, after prolonged study and numerous discussions, evolved a program for the use of some $17,000,000 awarded them by the United States Court of Claims. This represented 60 percent of a total judgment of $31,460,216.84 which the Uintah and Ouray Indians shared with their kinsmen of the Ute Mountain and Southern Ute Reservations of Colorado. The Tribal Business Committee of the Uintah and Ouray Reservation, through capable leadership, won the approval of the entire tribe for a program of economic and social development. The plan calls for expenditure of $5,000,000 over a 3-year period to rehabilitate the tribal economy. Items within the program include the purchase of Indian allotments in heirship status; the purchase of winter range to balance present holdings of summer range lands; the consolidation and blocking out of range lands through purchase and exchange; the subjugation of land; and the establishment of a credit fund for the benefit of the tribal members. The plan also contemplates that all educational facilities on the reservation will be transferred eventually to public school administration.

MANAGEMENT

The Bureau of Indian Affairs is unique among governmental agencies for the complex variety of activities entailed by its basic function. The Bureau administers many different activities that range in scope from the direct operation of supervising Indian land leases to the involved operation of formulating and implementing broad economic rehabilitation programs for Indian advancement. Aware of the importance of maintaining a high level of management practices in such a setting, the Bureau has acted in accord with Presidential and Secretarial directives to establish a continuing management improvement program.

Particular opportunities for management improvement existing in the Bureau were highlighted in studies of its operations conducted during the past year by the investigative staff of the House Appropriations Committee, Princeton University, and a well known management consultant firm. These studies delineated problem areas and in some cases proposed remedial measures. Some of the measures proposed have been initiated in the Bureau and others are under way.

The Bureau views management improvement as a continuing task, with primary responsibility for its success resting on all administrative personnel. Accordingly, field committees composed of key administrative officers have been established in each of the area offices to assume chief responsibility for the identifications of opportunities for management improvement and to propose specific measures to attain a smoothly functioning administrative mechanism. These proposals are to be geared into area-wide management improvement programs and rapidly scheduled for action. A small staff has also been provided in the central office to give guidance to the management improvement program on a Bureau-wide basis and to render assistance to field organizations when needed.

While several projects have been undertaken during the past year, there are three that are of significant importance to Bureau operations.

The Indian Affairs Manual is well along toward completion. This basic document, established in a formal format, sets forth the objectives, policies, delegations of authority, and detailed procedures for each organizational function. It is written in a manner calculated to relate the authority and responsibilities of each organizational function to each other and to the over-all Bureau program. Aside from its primary use as a ready reference for specific organizational units, it will serve to acquaint all personnel with the basic structure and over-all operations of the Bureau thereby leading to consistency in application of Bureau policies and procedures. Twenty-eight chapters of this key management tool have been released and others are being processed with priority.

Another important management improvement undertaking of the past year has been a study of the Bureau's reporting system and component reports. This study was begun by a study of central office reports and is to be extended to field organizations. The objectives of this study are to: (a) provide adequate data for program control at successive levels of the organization, (b) consolidate related and similar reports, (c) provide clear, concise, and complete reports, (d) establish a central control of the reporting system, and (e) screen reports on the basis of utility. The results of the study of central office reports are currently being reappraised, and a list of approved reports together with procedures establishing a Reports Control program will be published in the Indian Affairs Manual.

With the inclusion of nine formerly detached field installations within the area organization pattern, the way was cleared for completing the centralization of housekeeping functions in area offices. The primary benefit accruing from this move is an improved level of operation enabling present staff to meet the workloads mandatory to continued operation, whereas, formerly, it was inadequate for the task at hand.

THE LEGAL RECORD

Litigation

There were a number of significant court decisions on Indian matters during the year. Among them was *Begay* v. *Miller*, in which the Arizona Supreme Court held that a divorce in the Navajo Court of Indian Offenses was entitled to recognition by the State despite marriage under State rather than tribal law. In *Taunah* v. *Jones*, the Circuit Court of Appeals for the Tenth Circuit, reversing the lower court's decision, held that income from lands allotted under the General Allotment Act is subject to Federal income taxation. Also in the field of Federal income taxation, the Bureau of Internal Revenue reversed a prior ruling to hold taxable the income from Osage oil and gas royalties. An opinion of the Montana Supreme Court in *State* v. *Pepion* interpreted Federal law to exclude State law and order jurisdiction on non-Indian land within the exterior boundaries of Indian reservations. Potential recoveries in the Court of Claims and Indian Claims Commission on tribal claims were drastically curtailed by a decision of the United States Supreme Court in *Alcea Band of Tillamooks et al.* v. *United States*, which held that a Federal taking of lands to which a tribe had original Indian title was not a taking under the Fifth Amendment and therefore payment of interest on the value of the land from the time of taking was not required.

An action on behalf of the natives of the Hydaburg Reservation in Alaska was instituted against Libby, McNeil and Libby to recover damages for unauthorized use of a fishtrap site within reservation boundaries and to restrain future use of the site. Dismissal by the Federal district court of a suit brought at the Department's request to enjoin certain Navajo Indians from trespassing on public lands in Utah was appealed (*United States* v. *Hosteen Tse-Kesi et al.*); a defense of aboriginal rights is an issue in the case. The *Jimerson* case, discussed in last year's report, to compel the Commissioner to recognize a certain group as the governing body of the Seneca Nation was dismissed. At the year's close, additional information and legal memoranda were transmitted to the Department of Justice in support of an earlier request for legal action to recover possession of certain lands on the Pyramid Lake Reservation in Nevada.

Legislation

Early in the year responsibility for coordinating the Bureau's large volume of legislative work was centralized in the office of the chief counsel. The office prepared a proposed 1951 legislative program of the Bureau, which covered nearly 50 public bills, initiated a weekly reporting system and additional control procedures to expedite preparation and clearance of bills and reports on pending legislation, and played a large part in the drafting of major program bills, in addition to providing legal review and assistance in formulating final Bureau recommendations on many other bills. At the end of the year, over 100 legislative reports or legislative proposals for submission to the Eighty-second Congress, exclusive of reports on numerous patent-in-fee bills, had been transmitted by the Bureau to the Department.

Attorney Contract Policy

In November 1950 the Bureau issued a memorandum setting forth policies regarding approval of proposed contracts between attorneys and Indian tribes. Most of the policies itemized represented no substantial departure from those theretofore generally applied by the Bureau, and the primary purpose of the memorandum was to acquaint tribes and attorneys with the criteria being applied. The memorandum was, however, misunderstood and misinterpreted in some quarters and thus became the subject of widespread discussion. In the process there was full opportunity for expression of all points of view regarding the Bureau's policy on attorney contracts. Near the end of the year the Solicitor issued an opinion, at the request of the Secretary, on the extent of the Department's statutory authority to approve or disapprove attorney contracts, which in effect upheld the legal position taken by the Bureau. The drafting of regulations to formalize Departmental attorney contract policy is now contemplated.

Approximately 38 attorney contracts for the prosecution of tribal claims or general counsel services were approved during the year. In view of the impending deadline of August 12, 1951, for the filing of claims with the Indian Claims Commission, instructions were issued to the area offices in January to ascertain which tribes without claims attorneys wished to prosecute claims, to advise them of the need for early filing, and to obtain information on progress of claims of tribes having claims attorneys. At the close of the year 4 claims contracts were under review and the Bureau had information that 10 other claims contracts were in process of negotiation.

Office of the Solicitor

Mastin G. White, Solicitor

OPINIONS

DURING THE FISCAL year that ended on June 30, 1951, the Office of the Solicitor rendered 44 formal legal opinions. The following summaries indicate some of the positions which were taken by the office upon legal questions of importance to the Department:

M-33969.—The United States, acting through its authorized agents, may withdraw, reserve, or appropriate for a public purpose any unappropriated nonnavigable waters on the public domain, without complying with State laws governing the appropriation of water, and such action prevents the subsequent acquisition by private persons of rights in such waters pursuant to State laws.

M-36028.—A statutory provision declaring that the right of persons employed in the civil service to "petition Congress, or any Member thereof, or to furnish information to either House of Congress, or to any committee or member thereof" shall not be interfered with does not restrict the authority of the head of an executive department to determine with finality whether the disclosure of official information under his jurisdiction would or would not be prejudicial to the public interest, and does not prevent him from promulgating a regulation prohibiting employees of the department, in the absence of permission from the head of the department or his representative, from disclosing confidential information to Members of Congress.

M-36040.—The provisions of the constitution adopted by an Indian tribe pursuant to the Indian Reorganization Act cannot disregard or dispense with a requirement imposed by an act of Congress in connection with the leasing of tribal lands for mining purposes.

M-36047.—This Department cannot conduct soil and moisture conservation activities on lands under its jurisdiction for the purpose of benefiting privately owned lands in the vicinity or of protecting installations that are under the jurisdiction of other Federal agencies.

M-36049.—The Mineral Leasing Act for Acquired Lands is applicable to lands in the Natchez Trace Parkway.

M–36060.—Functions vested in subordinate officers of the Department, or in departmental employees or agencies, by legislation enacted after the effective date of Reorganization Plan No. 3 of 1950 are not affected by section 1 (a) of that plan, which transferred to the Secretary of the Interior all the functions vested in other officers of the Interior Department or in departmental employees or agencies.

M–36064.—The payment of claims based upon property damage, personal injury, or death arising out of nontortious activities of the Bureau of Reclamation is discretionary with the Department.

M–36069.—In examining contracts between unorganized Indian tribes and attorneys, the Secretary of the Interior may consider such a contract as a whole and approve it or withhold approval from it as his judgment may dictate, and he may condition his approval upon such requirements as he deems to be necessary or advisable in order to protect the interests of the Indians; but in examining contracts between organized Indian tribes and attorneys, the Secretary's authority is limited to matters which have a reasonable relationship to the choice of counsel or the fixing of fees, although the Secretary is vested with wide discretion in determining what factors have a reasonable relationship to such subjects.

M–36071.—The Secretary of the Interior has the authority to insert, in patents conveying to States, counties, or municipalities public lands chiefly valuable for recreational purposes, a provision barring racial discrimination in the use of the lands.

M–36083.—An oil and gas lease on a tract of public land should be granted by means of competitive bidding in a situation where the tract was not within any known geological structure of a producing oil or gas field at the time when the initial application for a lease was filed by a qualified person but, as a result of subsequent developments on other land in the vicinity, the tract is known to be within the geological structure of a producing oil or gas field as of the time when the Department is ready to grant a lease on the land.

M–36084.—Submerged lands lying seaward of the line of ordinary low tide along the coast, and situated outside the inland waters of the States, are not "public lands" and, accordingly, cannot be selected under public-land scrip.

APPEALS

Personnel of the Solicitor's Office devoted a great deal of time and effort during the fiscal year 1951 to the preparation of decisions on formal appeals taken to the head of the Department by persons dissatisfied with decisions previously rendered by bureau officials. The office disposed of 435 such appeals during the course of the fiscal year. These included 22 appeals in connection with claims based upon property damage or personal injury, 46 contract appeals, 19 appeals involving Indian affairs, and 348 public-land appeals.[1] Some of the more important decisions that were rendered on appeals are summarized below:

Davidson Hill and Kenneth M. Willson (A–25883).—The Secretary of the Interior has the authority to restore to Indian tribes the ownership of mineral deposits which were reserved to the United States when the surface of ceded Indian lands was patented to private persons.

Jesse W. White et al. (A–25904).—The holder of a noncompetitive oil and gas lease is not entitled to a 2-year extension of his lease with respect to any tract covered by the lease which, on the expiration date of the primary term of the lease, is situated within the known geological structure of a producing oil or gas field, unless on such date drilling operations are being diligently prosecuted on the tract; and the fact that, on the expiration date of the primary term of the lease, drilling operations are being diligently prosecuted on another portion of the leased area, which is not within the known geological structure of a producing oil or gas field, does not effect a 2-year extension of the lease with respect to the tract first mentioned.

Idaho Power Company (A–25936).—It is within the discretionary power of the Secretary of the Interior to impose, among the terms and conditions which must be agreed to by applicants for rights-of-way for electric-power transmission lines across lands under the control of this Department, a condition that the applicant will permit the Department to utilize the surplus capacity of the line, or to increase the capacity of the line, for the transmission of Government power.

John Robert Claus; Richard H. Yoder (A–25937).—The cultivation requirements for a commuted homestead entry are the same as those for an ordinary homestead entry, i. e., the entryman must cultivate one-sixteenth of his entry in the second year of the entry and one-eighth of the entry in the third year of the entry and until the submission of final commutation proof.

State of Alabama (A–25955).—A State may properly be regarded as a "citizen of the United States" within the meaning of that term as used in the Color of Title Act, and may apply for the benefits of that act.

D. K. Edwards et al. v. *Albert G. Brockbank et al.* (A–25960).—When two classes of land are dealt with in an order revoking a previous withdrawal, and with respect to one class a future date for the effectiveness of the revocation order is specified, while with respect to the other class no date for the effectiveness of the revocation order is mentioned, the lands in the latter class become subject to application when the revocation order is filed with the Division of the Federal Register.

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[1] Approximately 200 of the public-land appeals involved the same legal point, i. e., the applicability of the Mineral Leasing Act to submerged coastal lands.

State of California (A–26141).—In determining whether land should be classified as suitable for State indemnity selection, the primary factor, but not the only factor, is whether any Federal interest makes a negative determination advisable. The effect of the allowance of the selection upon the pattern of land use in the area and upon the use of adjoining land by the owners of such lands may also be considered.

Estate of Fred White Eagle (IA–35).—Statutory provisions prohibiting any person employed in Indian affairs from having any interest or concern in trade with the Indians, except for, or on account of, the United States, preclude the allowance of a claim for compensation made against the estate of a deceased Indian by a person who was an employee of the Indian Service during the period when the alleged services were rendered to the decedent.

Estate of James Roberts (IA–37).—A substantive regulation issued by the Department to govern the creation of a valid obligation to provide compensation for care rendered to an Indian during his lifetime should not be applied retroactively in disposing of claims relating to a period antedating the promulgation of the regulation.

LITIGATION

Several important court decisions affecting programs of this Department were rendered during the fiscal year 1951.

In *United States* v. *Alcea Band of Tillamooks et al.*, 341 U. S. 48, the Supreme Court ruled that, in an award of compensation to the Indians for lands which had been held by them under aboriginal title and had been taken from them by the United States, the Indians were not entitled to receive interest on the value of such lands, since the liability of the Government did not rest upon the Constitution but upon the provisions of the special jurisdictional act pursuant to which the litigation was instituted.

The case of *Taunah et al.* v. *Jones*, 186 F. 2d 445 (10th Cir.), cert. denied, 341 U. S. 904, established the principle that the income from lands held in trust for individual Indians by the United States is subject to taxation under the Federal revenue acts.

In the three *Preston* cases, 181 F. 2d 62, 68, and 69 (9th Cir.), cert. denied, 340 U. S. 819, the rule was announced that lands held in trust by the United States for individual Indians may be impressed with a lien as security for the payment of attorneys' fees, and that the lien may be enforced through the sale of such portion of the lands as may be necessary to satisfy the lien.

It was held in *West Coast Exploration Co.* v. *Oscar L. Chapman* (D. C., unreported), that the Secretary of the Interior acted correctly in rejecting the plaintiff's application to locate Gerard scrip upon a tract of public land known to contain valuable mineral deposits.

In *United States* v. *Harry Theodore Petersen et al.* (S. D. Calif., unreported), it was held that the United States has exclusive jurisdiction over privately owned lands located within the exterior boundaries of Kings Canyon National Park, Calif., and that the Secretary of the Interior has the authority to issue regulations governing the sale of alcoholic beverages on privately owned lands within the boundaries of the park.

The court's decision in *Continental Oil Co. et al.* v. *United States*, 184 F. 2d 802 (9th Cir.), upheld the authority of the Secretary to reserve in oil and gas leases the power to determine the value of the oil and gas produced under such leases, for the purpose of computing the amounts of the royalty payments due the Government.

SUBMERGED COASTAL LANDS

On December 11, 1950, the Supreme Court entered its decrees in the cases of *United States* v. *Louisiana*, 340 U. S. 899, and *United States* v. *Texas*, 340 U. S. 900. These decrees enjoined the respective States, and their lessees, from conducting within the submerged coastal lands any activities for the purpose of taking or removing any petroleum, gas, or other valuable mineral products from such lands, except under authorization first obtained from the United States.

It thereupon became necessary to consider the nature and basis of the authority of the Secretary of the Interior with respect to the continuation of the oil and gas operations which were in progress within the submerged coastal lands on the date when the decrees were entered. It was concluded that, under the implied power of the Secretary of the Interior to protect property under his administrative jurisdiction and control against damage or loss, he could permit the continued production of oil and gas from wells which had been completed prior to December 11, 1950, and that he could permit the completion of wells which were in the process of being drilled on that date. Accordingly, a general authorization to permit the continuation of such operations was issued by the Secretary on December 11, 1950, following the entry of the Court's decrees.

Personnel of this office collaborated in the drafting of a new stipulation between the United States and California with respect to oil and gas operations in the submerged lands along the California coast pending the fixing by the Supreme Court of the line of demarcation separating lands beneath the marginal sea, on the one hand, from tidelands and lands beneath navigable inland waters, on the other hand.

PATENT MATTERS

The Office of the Solicitor rendered during the fiscal year 1951 a total of 47 decisions in adjudicating the respective rights of the Government, on the one hand, and of departmental personnel, on the other hand, in inventions made by the latter.

In one of these cases (P–87), it was held that the execution by an employee of an assignment to the United States of all rights in an invention precluded the Department from later authorizing the employee to obtain, on his own behalf, patent rights on the invention in foreign countries, even though the Government had decided that it would not obtain any foreign patent rights on the invention.

The patent regulations of the Department (other than those dealing with the subject of licenses) were revised in order to bring them into conformity with administrative orders issued by the chairman of the Government Patents Board, with the approval of the President.

TORT AND IRRIGATION CLAIMS

During the fiscal year 1951, the Office of the Solicitor disposed of a total of 104 claims based upon property damage or personal injury.[2]

DEPARTMENTAL ORDERS

This office prepared or assisted in the preparation of numerous departmental orders during the fiscal year 1951. Among the more important of these orders bearing on the organization of the Department were those establishing the Office of Assistant Secretary for Mineral Resources, the Office of Assistant Secretary for Water and Power Development, the Office of Assistant Secretary for Public Land Management, the Division of Water and Power, the Division of International Activities, and the several defense administrations. Orders dealing with the internal management of the Department included those relating to travel, personnel actions, the use of Government-owned vehicles, an incentive awards program, a departmental safety program, and a records management program.

DEFENSE ACTIVITIES

The assignment to the Secretary of the Interior of major responsibilities under the Defense Production Act of 1950 resulted in a substantial increase in the work of the Solicitor's Office. The services of the office were required initially in connection with the establishment of the five defense administrations in the Department. Throughout the remainder of the year, the office was called upon to consider numerous matters arising both from the defense activities of the Department and from the activities of the other defense agencies of the Government. The greater part of the work dealt with the problems and procedures relating to priorities and allocations and to financial assistance under the Defense Production Act of 1950. A small Defense Division was established in the Solicitor's Office for the handling of legal work under the Defense Production Act of 1950.

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[2] This figure does not include the decisions rendered on appeals from the actions of field attorneys upon such claims.

LEGISLATION

Statutes of major importance to the Department of the Interior enacted during the fiscal year 1951 are indicated below:

The people of Puerto Rico were given a larger measure of self-government through the enactment of Public Law 600, approved July 3, 1950. This law permits the people of that island to frame and adopt an insular constitution, which will become effective upon approval by the Congress. No change, however, can be made in the political and trade relations between Puerto Rico and the United States.

Authorization for the construction, operation, and maintenance of the Eklutna hydroelectric power project in Alaska was granted by Public Law 628, approved July 31, 1950. This project, located near Anchorage, will supply power for essential military and civilian needs in an area where a critical power shortage exists. The Eklutna project is the first project for the development of the water-power resources of Alaska to be authorized by the Congress.

The people of Guam were given statutory rights of self-government through the enactment of Public Law 630, approved August 1, 1950. Under this law, a civil government is now functioning in Guam for the first time since that island came under the American flag by virtue of the Treaty of Paris in 1898. The new law extends to the people of Guam the same fundamental civil guarantees that are embodied in the Bill of Rights of the Federal Constitution. It permits them to elect an insular legislature, with the power to act on all subjects of local application, although the insular legislation must not be inconsistent with Federal statutes.

A comprehensive program of Federal aid to the States for the restoration and management of fishery resources was authorized by Public Law 681, approved August 9, 1950. This program is designed to complement the similar program for wildlife resources established in 1937. The funds to finance the fishery program will be derived from existing Federal excise taxes on sport-fishing tackle, thus relating the burden of its cost to the tax revenues received from the sport fishermen who enjoy its benefits. Funds so derived will be available for assisting the several States, on a matching basis, in undertaking approved fish restoration and management projects.

Considerations of national security led to the adoption of Public Law 774, approved September 8, 1950, which is generally known as the Defense Production Act of 1950. This act authorizes the President, for the purpose of promoting the national defense, to control the use of essential materials and facilities, to provide financial assistance for industrial expansion, and to regulate prices, wages, and credit. Delegations made under its provisions have placed upon the Secretary of the Interior wide responsibilities with respect to the administration of electric power, petroleum, natural and manufactured gas, coal, coke and other coal byproducts, minerals, and fisheries.

The sound conservational use of one of the most majestic and colorful areas of our country was assured through the enactment of Public Law 787, approved September 14, 1950. The effect of this law is to establish a new Grand Teton National Park, by adding to the existing park of that name the larger part of the lands previously comprised within the Jackson Hole National Monument. It also adjusts satisfactorily a number of local issues that had impeded proper administration of the monument ever since its establishment in 1943. The new consolidated Grand Teton National Park will preserve for all time a region of rare scenic, historic, recreational, and scientific interest.

Continuance of the synthetic liquid fuels program was made possible through the enactment of Public Law 812, approved September 22, 1950. This measure extends until April 5, 1955, the effectiveness of the synthetic liquid fuels legislation, and increases to $87,600,000 the appropriation authorization contained in that legislation. The research and development work now being conducted in this field has already made much progress toward its goal of unlocking the liquid fuel resources contained in our great reserves of coal and oil shale, as well as in underground reservoirs of natural gas.

The construction, operation, and maintenance of the Canadian River reclamation project in Texas were authorized by Public Law 898, approved December 29, 1950. This multiple-purpose project will materially assist the people of the Panhandle-South Plains area of northwest Texas in overcoming water-supply problems of a serious nature. These problems stem from the fact that the domestic and industrial water supplies of this rapidly growing area are obtained from a ground-water basin which is being depleted at a rate far greater than the replenishment possible from the limited local rainfall. The project will conserve this irreplaceable natural resource by diverting unused surface water from the Canadian River to 11 cities and towns now dependent on excessive pumping from the underground basin. This legislation is also of interest as being the first instance where the provision of water for municipal use has constituted the primary inducement for the authorization of a Federal project.

Office of Territories

James P. Davis, Director

THE PAST YEAR has brought a dramatic increase in the responsibilities of the Office of Territories as Federal guardian of the rights and interests of United States citizens who have not yet achieved the benefits of statehood. Already accustomed to operations over far-flung areas, the Office has seen its geographical influence tremendously enlarged by transfer to its jurisdiction of the islands of Guam, American Samoa, and the Trust Territory of the Pacific. In the case of Samoa and the Trust Territory, the effective date of transfer from control by the Navy was July 1, 1951, but the major work of accomplishing the transfer was done during the fiscal year.

In all the areas under its jurisdiction, the Office of Territories has continued to carry out the primary functions for which it was established. The significance of these functions has been greatly augmented by international events. In areas where full self-government has not yet been achieved under the flag of the United States, the Office of Territories is demonstrating the practical value of democratic institutions as opposed to communism. By its encouragement of political responsibility and by its efforts to give territorial peoples, some of them in undeveloped lands, the fullest possible participation in governmental activities, the Office is aiding in establishing barricades against the baneful influence of totalitarian propaganda.

Except for specific economic enterprises in Alaska, Puerto Rico, and the Virgin Islands, the Office of Territories is not an operating agency. It is responsible through the Secretary for reporting to the President and to Congress upon developments in the territories. It seeks through policy planning and legislation, in cooperation with territorial governments and other Federal agencies who serve the Territories, to insure sound and rapid development. It acts in Washington as representative of the governors and of any citizen of the territories who wishes to call upon it for assistance. The Office cooperates with both the terirtories and the State Department in matters of foreign policy that are of concern to them. The operating responsibilities of the Office of Territories, while extensive, are confined to the supervision of specific enterprises as the Alaska Road Commission, The Alaska Railroad, the Puerto Rico Reconstruction Administration, the Virgin Islands Corporation, and the Public Works programs in Alaska and the Virgin Islands.

The year has seen the United States engaged in a vast program of national defense. This program requires major emphasis on industrial capacity, agricultural production, and wise use of natural resources. The Office of Territories, within its field, is directing its efforts toward the establishment of the kind of economic and political climate which is most favorable to the effective mobilization of economic resources. The reports that follow of developments during the year in Alaska, in the Caribbean, and in the Pacific are more in terms of people than of things. They call attention again to the fundamental fact that the primary resources of any land are the men and women who are both bound and made free by the ties of citizenship.

ALASKA

Military considerations have made the development of Alaska a matter of major importance to the entire United States as well as to Alaskans. Its resources, actual and potential—its manpower, Indian, Eskimo and white—its possibilities for economic expansion—all are matters of major concern as never before in the history of the Territory. In cooperation with the government of the Territory, with other bureaus of the Interior Department and with other Federal agencies, the Office of Territories is contributing to the growth of Alaska by encouraging the adoption of progressive economic and social policies.

Legislation for Statehood and Public Power

Though the outlook for enactment of H. R. 331, the Statehood Act for Alaska, was favorable at the close of fiscal year 1950, the bill was not acted upon by the Senate after having passed the House of Representatives. Legislation was again introduced in the Eighty-second Congress to provide for the admission of Alaska into the Union and the campaign will continue with the active help of the Office of Territories until statehood has been achieved. The majority of Alaskans want the rights and privileges which statehood brings, and under democratic institutions, their wishes in the long run will not be denied.

Authorization for the construction, operation and maintenance of the Eklutna hydroelectric power project was granted by Public Law 628, approved July 31, 1950. The project is designed to provide 30,000 kilowatts of electric power to Anchorage and Palmer, important industrial and agricultural areas. It will meet essential military and civilian power needs in an area where a critical power shortage exists. Eklutna is the first Federal project to be authorized by the Congress for the development of the water power resources of Alaska.

Territorial Reorganization

A further step was taken to provide a sound financial organization for Alaska when the 1951 Territorial legislature passed a bill reorganizing the fiscal system. The statute, effective July 1, 1951, is based on the results of a thorough study of the previously existing financial agencies and provides for centralized budgeting, auditing, accounting, property control, and treasury management. The new organization, headed by a board of administration with the Governor as chairman, and the attorney general, tax commissioner and four Territorial legislators as members, reflects the fiscal requirements of the Territory of Alaska, as well as the experience of the various States in controlling their receipts and expenditures.

Meeting the Housing Shortage

During fiscal 1951, the Alaska Housing Authority continued through its housing program to encourage the establishment of a sound and self-sufficient building industry in the Territory. The population growth of Alaska, 77.4 percent in the 1940–50 decade, had seriously increased the pressure on housing, but toward the end of the fiscal year the results of earlier construction of housing units began to appear. Through the remote dwelling program, directly meeting the problems of native housing, the Alaska Housing Authority provided materials for 435 Eskimo homes located in 23 outlying villages.

Portions of the Government Hill area, Anchorage, were surveyed and released for sale as home sites. The project was begun by The Alaska Railroad in order to provide housing for its employees. Its sale permits owners to obtain Federal Housing Administration financing for the construction of permanent homes on the lots. Completion of a 682-unit apartment development in the reserved portion of the Government Hill section was announced toward the end of the fiscal year. Composed of efficiency and one- and two-bedroom units, the development will contribute toward alleviating the Anchorage housing shortage.

Alaska Public Works Program

The Alaska Public Works program, in its first full year in the Office of Territories, continued to provide essential facilities for Alaska communities, to be purchased by these communities at a price averaging 50 percent of actual cost as required by the authorizing legislation (Public Law 264, 81st Cong.). Work was commenced on all but 3 of the 18 projects which had been allotted prior to June 30, 1950. Bids were opened on the three remaining projects (all schools) but were so high that plans and specifications had to be revised before readvertising.

Additional allotments were made for 13 projects, all of which were certified by the Department of Defense as being of value to national defense. The estimated cost of the projects for which allotments were made in fiscal 1951 exceeds $3,800,000, the balance of the $4,000,000 appropriated being held in reserve for contingencies. Work has already started on the Territorial Office Building, the first project allotted. Plans and specifications are being prepared for the remaining projects which will be put under construction as soon as contracts can be awarded.

A tentative list of projects to be constructed from the 1952 appropriation has been submitted to the Department of Defense for certification. These projects will be ready for allotment as soon as funds are appropriated and it is anticipated that this will occur in time to permit preparation of plans and specifications during the coming fall and winter. Construction could then be started in the spring of 1952.

The staff of the Alaska District Office is being increased and, insofar as practicable, the work is being decentralized to permit its handling in the district office.

Alaska Railroad Operations Exceed War Time Peaks

Fiscal year 1951 was the fourth year of The Alaska Railroad's $75,000,000 rehabilitation program, the completion of which is providing the Territory with modern and efficient rail service. As the fiscal year ended, freight traffic was substantially exceeding the peak loads of World War II, with military requirements accounting for a very large percentage of the total.

In spite of rehabilitation efficiency and heavy traffic, the pinch of inflation was being felt. The Railroad has not raised tariffs since 1937 and, in fact, has lowered rates on some important commodities. Before the fiscal year ended, agreements had been reached with representatives of Alaska Railroad unions, which, upon approval by the Secretary and the Wage Stabilization Board, will add over $1,350,000 to its annual pay roll. The Alaska Railroad may well be the only enterprise in the United States that has attempted to meet its 1951 costs with income in terms of 1937 dollars.

During the year, final shipments of 115-pound rail to replace old track were received and relaying was begun on the rest of the line from Portage to Fairbanks, where high steel is not yet in place. As a result of the improvements made on theRailroad, running times have been shortened so that interior points receive faster delivery from the rail ports of Seward and Whittier, and the ton-mile capacity of the Railroad has been greatly increased.

On the basis of a $1,500,000 appropriation, work was begun on a minimum reconstruction program for the Seward-Portage line designed to include only those items essential to continued operation on this portion of the Railroad including reconstruction of the Seward dock, which was also begun, and when completed will be capable of discharging two ships at once, thus facilitating the handling of cargo in the port and reducing turn-around time of vessels. Certain old and dangerous bridges on the line are being replaced by steel structures. It was also found to be possible to eliminate the famous Loop structures whereby the Railroad makes a one and three-quarters turn through constructing a 3-percent grade across a glacial moraine. The loss of a scenic feature of the Railroad will be compensated by the elimination of the need for expensive maintenance of the system of bridges comprising the Loop.

The operations of the Railroad were seriously hampered by a fire on January 15, 1951, which destroyed the main shop and coach shed at Anchorage, headquarters of the Railroad. Among the property lost were four locomotives, seven cars, and a considerable quantity of machinery and other equipment essential to the operation of the Railroad. A supplemental appropriation of $4,000,000 was obtained to replace these essential facilities with modern and well-designed structures. Reconstruction was begun early in the spring.

The Alaska Railroad has undertaken a project with the Chugach Electric Association to erect a steam and power plant at Anchorage. The Diesel phase of the project has been completed and the entire project is scheduled for completion at the end of 1952.

Modern Highways for Alaska

The Alaska Road Commission geared its fiscal 1951 road program to the requirements of the military in preparing for the defense program. The major emphasis was given to further improvement of the main arteries, hard surfacing, replacement of bridges, and elimination of hazardous sections of road. As a result of prior efforts of this organization, the main routes, the Alaska, Richardson, Glenn, Sterling, and Steese Highways, are dependable roads capable for the most part of meeting any defense need.

During the fiscal year, large portions of the Richardson and Glenn Highways were surfaced, bringing them up to first-class standard. The construction of permanent shop facilities and housing, and financial aid from the military establishment in Alaska made it possible to keep Thompson Pass on the Richardson Highway open for the second successive winter, thereby providing interior Alaska with access to the year-round port of Valdez. Realinement and other improvements completed in the summer of 1951 will facilitate maintenance of the pass. In direct connection with the defense effort, construction on several stretches of road, such as the Big Delta firing range road, was initiated at the specific request of the military.

The highway north of Seward to the Turnagain Arm project is under reconstruction to eliminate hazardous road conditions and provide a high-standard through route from Seward to Anchorage. This road is expected to be open to traffic by the end of the 1951 season. Additional work was done on the road from the Alaska Highway to Eagle on the Yukon River and to Dawson, Yukon Territory, Canada. This road, already in passable condition to Dawson, is planned to be open to traffic throughout its length at the 1951 season's end. The road will make readily accessible the Forty-Mile and Eagle mining districts, thus encouraging the further development of the resources of this area. As a result of paving work done in the spring of 1951, the highway from Haines to the Canadian border is complete.

Discussions were initiated with the appropriate agencies of the United States and Canadian Governments looking forward to the establishment of joint border station facilities on the Alaska Highway. As tentatively planned, the station will provide space for customs, immigration, and vehicle inspection officials and will also include lodging and other facilities for travelers.

Aviation

The completion of the airports at Seldovia, Ninilchik, Kotzebue, Dillingham, and Fort Yukon marked the first year of the Federal-aid airport program in Alaska. These airports provide much-needed facilities to their respective areas and will improve both passenger and freight transportation in the Territory.

In addition to the completed fields, preliminary investigations and plans were made for several sites for future airports. First in priority has been the investigation of an auxiliary field on College Hill at Fairbanks. Since the opening of the new International Airport, it has been discovered that there is definite need for an auxiliary field to avoid the fog that occasionally blocks visibility in cold weather in the Fairbanks area. During summer months, the unsurfaced auxiliary field would be used for small private planes and by the University of Alaska.

Indians and Eskimos Add to the Labor Force

Under a joint agreement, the Alaska Native Service and the Territorial Employment Service initiated a program for recruiting and placing natives in jobs throughout the Territory. One of the largest single employers of natives was The Alaska Railroad, which, by April 1951, had hired approximately 200 Eskimos for its summer work program. It is expected that more effective use of this local labor will not only greatly improve the economic situation of Indians and Eskimos, but will add much-needed increment to Alaska's permanent labor force.

Cement Costs Down

The recent establishment of cement silos in Anchorage and Fairbanks has resulted in lowered prices for bulk cement in railbelt cities. In the hopes of finding ways to lower cement costs still further, a study of the cement problem in Alaska was initiated in fiscal 1951. The study includes a market and raw materials analysis, the latter based for the most part on the results of recent investigations carried out by the Geological Survey and the Bureau of Mines. In view of the rapidly increasing number of civilian and military construction projects, the development of an economically-feasible Alaskan cement industry using local raw materials appears promising.

Arctic Investigations and Alaskan Science

Under the auspices of the Arctic Institute of North America, jointly sponsored by the United States and Canadian Government as well as several private organizations, three centers have been established for the collection of scientific data on the Arctic regions of North America. They are located at the University of Alaska; McGill University, Montreal; and at Washington, D. C. During the year, several research projects for government agencies were carried out while work continued on collecting basic data. This information, when assembled at the three centers, will be available to interested public and private agencies. In November 1951, the first annual Alaska Science Conference was held in Washington with Interior Department officials participating. The second annual conference will be held at Mount McKinley National Park, Alaska.

PUERTO RICO

Progress Toward Self-Government

Public Law 600, passed by the Eighty-first Congress, authorized the convening of a constitutional convention and the drafting of a Puerto Rican Constitution, but provided that the law itself was subject to acceptance by the people of Puerto Rico. They voted overwhelmingly to avail themselves of its benefits. While Puerto Rico's political and economic relationship to the United States will remain the same, the insular government will operate, following the adoption of the constitution, and its approval by the Congress, under basic laws which have been established by the people of Puerto Rico rather than by the Congress. In accordance with procedures promulgated by the insular legislature, the election of delegates to the constitutional convention will be held August 27, 1951. A special districting of the Island has been carried out to assure representation of the several political parties of Puerto Rico and also to provide for delegates-at-large. The constitutional convention will assemble on September 13, 1951.

Industrialization and Employment

A new instrumentality, the Economic Development Administration, was established in July 1950 to give continued leadership to the insular government's industrial development program. The EDA carries on the industrial promotion, research and tourism activities of the Puerto Rico Industrial Development Company. It has, however, a somewhat broader scope of authority, since it also exercises the functions of the Puerto Rico Transportation Authority and certain other activities which were formerly not within the jurisdiction of the Development Company.

The insular government sold to private interests the four factories (glass, cement, paper, and clay) which it had built and operated as a demonstration that such manufacturing operations could practicably be carried on in Puerto Rico. It had previously announced its intention to step out of the manufacturing field as soon as private capital could be persuaded to take over the plants.

Early this year the one hundredth manufacturing plant to be put into operation since the inauguration of "Operation Bootstrap" was started. New enterprises are now being established at the rate of 1 every 9 days. It is hoped that the island will gain new manufacturing capacity in the amount of about $30,000,000 a year for the next 10 years. If this goal is achieved, Puerto Rico's chronic unemployment and under employment may be materially reduced.

A substantial number of Puerto Ricans, whose employment opportunities are inadequate at home, have emigrated each summer in recent years to the continental United States. Some of these workers have found industrial jobs, but by far the larger number has gone into agricultural work, especially in areas of marked seasonal agricultural employment, such as New Jersey and Michigan. In the early summer of 1950, for example, 5,000 workers were flown to Saginaw, Mich., for work in the sugar beet fields. Altogether, during the summer of 1950 over 8,000 workers came to the mainland. A considerably larger number of Puerto Ricans have come to the continent for similar types of agricultural work during the summer of 1951. This migration has the dual beneficial effect of reducing unemployment in the island and of supplying urgently-needed agricultural and industrial workers on the continent. Puerto Rico has recently established a territorial employment service affiliated with the United States Employment Service which will materially assist in this process.

Sugar Production Increases

Sugar, Puerto Rico's leading crop, was produced in the amount of 1,286,000 tons in 1950–51. This exceeded the record crop of the previous year and has led to increasing pressure for an upward revision in Puerto Rico's quota of the domestic sugar market. The 1949–50 sugar production average was 1,281,000 tons which suggests that the high rate of production of recent years represents, in all probability, a continuing condition.

Puerto Rico's Contribution to the Defense of Korea

Since the early days of the war in Korea, the Sixty-fifth Infantry Regiment, composed largely of Puerto Rican volunteers, has been performing heroically. This important contribution to the Armed Forces of the United States and the United Nations has served to emphasize both in Puerto Rico and in the continental United States that Puerto Rico has given and continues to give valuable assistance in the defense of the free world.

Nationalist Activities of October 1950

At the end of October 1950, a small group of political extremists of the Puerto Rican Nationalist Party fired on the Governor's Palace in San Juan. A series of acts of violence occurred at a number of other places in the island. On the following day two Puerto Ricans of the Nationalist Party attempted to shoot their way into Blair House, the temporary Washington residence of the President. One of these individuals was killed on the scene and the other has since been sentenced to death. The disorders in Puerto Rico were quickly brought under control by the local authorities. Governor Munoz Marin in various public utterances at the time expressed the deep regret of the Puerto Rican people over these disturbances. He emphasized that the Nationalist Party, in seeking independence from the United States through acts of violence, represents the views of not more than 400 or 500 persons out of a population of over 2 million.

Air Travel

During the year the Civil Aeronautics Board, with the President's approval, authorized a second carrier to operate scheduled flights on the direct New York-San Juan route. The new service has been inaugurated and represents marked progress in the efforts of the Federal and insular governments to obtain expanded and less costly transportation services for Puerto Rico.

Social Security Legislation

Amendments made by Public Law 734 of the Eighty-first Congress extended to Puerto Rico the old age and survivors insurance and the public assistance provisions of the Social Security Act. The provisions of title II of the act, relating to old age-survivors insurance and requiring the payment of taxes had to be accepted by the people of Puerto Rico. The insular legislature passed the necessary enabling legislation in September. It is expected that the public assistance program will provide about $4,250,000 in Federal aid annually to the island.

Technical Training Under Point Four

The Office of Territories is administering a training program in Puerto Rico for foreign nationals under the Point Four program, which has been in operation since January 1950. Under Public Law 535, Eighty-first Congress, grants are made by the office to foreign nationals at the request of their governments. In addition, trainees awarded grants by other Federal agencies are sent to Puerto Rico for part of their training. The facilities for training in Puerto Rico are available upon request to persons granted fellowships under the Technical Assistance programs of the United Nations and to specialzed agencies. Training in Puerto Rico consists of on-the-job training vithin the agencies of the Puerto Rican Government dealing with roblems in the fields of interest to the trainees.

The Puerto Rico training program actually began under Public aw 402 in January 1950. At that time the Department of State uthorized sufficient funds for 12 Type A grants for training in Puerto Rico in the Water Resources Authority, Aqueduct and Sewer Auhority, and the School of Tropical Medicine. Before the end of the 1950 fiscal year, as a result of the large number of applications for hese grants, the Office made a total of 16 Type A grants for training n Puerto Rico. These grants included seven in the Aqueduct and Sewer Authority, to engineers from Haiti, Costa Rica, Bolivia, Brazil, Chile, and Ecuador; 8 in the Water Resources Authority from Bolivia, Chile, Costa Rica, Ecuador, El Salvador, Peru, and Uruguay; and one grant in the School of Tropical Medicine to a doctor from Mexico. The first of these trainees arrived in Puerto Rico in May 1950. Since all of the grants were for a full year's training, these 16 trainees were in Puerto Rico during the major portion of the fiscal year 1950–51.

A total of 11 secondary trainees, that is, trainees awarded grants by other agencies who spent part of their training period in the States and a part in Puerto Rico, were in Puerto Rico during the past fiscal year. These trainees, in the fields of labor statistics, labor standards, cooperatives, agriculture, wage and hour and rural social welfare, came from the Dominican Republic, El Salvador, Peru, Haiti, Nicaragua, Malaya, Egypt, and the Philippine Islands.

Puerto Rican facilities for training were also available to United Nations Fellows. A total of 19 trainees and 9 students, with fellowships from the United Nations and its specialized agencies, were in Puerto Rico during the fiscal year.

In addition to the 55 persons who were in Puerto Rico under grants from Point 4 or the United Nations, there were 19 visitors and trainees and 9 students at the university, who were there at the expense of their own government, at their own expense, or as guests of the Government of Puerto Rico. Among this group of nongrant visitors and trainees, were the ex-President of Costa Rica, the Director and Assistant Director of Personnel of El Salvador, the Deputy Director of Public Housing of Guatemala, the Director of Housing and an outstanding architect from Peru, and the Executive Vice President of the Production Development Corporation of Chile. At the University of Puerto Rico there were six students from Venezuela and three students from Colombia, whose expenses were being paid by their own governments.

The administration of the Puerto Rico training program was financed completely by the Government of Puerto Rico up until January 1951 under an appropriation of $50,000 by the Puerto Rican legislature. The Federal government provided the money only for grants to foreign nationals wishing to do their training in Puerto Rico.

In February 1951 a memorandum of agreement was signed by the Technical Cooperation Administration of the Department of State, and the Office of Territories, with the approval of other Federal agencies, whereby the Puerto Rico training program was authorized as a TCA project, and a budget for the administration was approved with funds allocated to the Office of Territories. The total amount of this budget was $79,403.98, which included grants in the amount of $57,143 and administrative funds in the amount of $22,260.98. The Government of Puerto Rico appropriated $25,000 for this project in 1951–52, so that the Puerto Rico training program became a joint program under Point Four, administered and financed by the Office of Territories in cooperation with the Government of Puerto Rico.

In March 1951 a project for the training of applicants from the area under the jurisdiction of the Caribbean Commission, to receive vocational training at the Metropolitan Vocational School in Puerto Rico, was authorized. Under this project $38,250 was allocated to the Office of Territories, which made a contract with the Metropolitan Vocational School for the carrying out of the project. Under the contract the Metropolitan Vocational School gives free tuition and provides the material required in the training, and Point Four funds are used for additional subsistence for the students already enrolled and provide for subsistence for a minimum of 30 students during the next fiscal year.

Ten new grants were awarded for trainees to go to Puerto Rico during the fiscal year 1951–52. These grants were made to applicants from Mexico, El Salvador, Peru, and Colombia, in the fields of water resources, public health, school of tropical medicine, and vocational training.

An official of the University of Costa Rica is now in Puerto Rico making a study of the facilities of training, looking toward the Government of Costa Rica requesting grants for some 15 or 20 Costa Ricans in various fields of economic development. The United Nations has already requested training for 15 United Nations Fellows during the next fiscal year, and anticipates sending more than the total sent during this fiscal year.

PUERTO RICO RECONSTRUCTION ADMINISTRATION

Operations were financed with allotments out of the Puerto Rico revolving fund for projects approved by the President, as follows:

Operation and maintenance of housing projects	$226,000.00
Operation of Castaner farm project	71,000.00
Servicing of loans to cooperatives	9,600.00
General administration	[1] 242,000.00
Repairs to buildings, etc	88,000.00
Construction of 250 latrines	13,000.00
Construction of 100 rural houses	120,000.00
Replacement of unserviceable roofs	40,000.00
Surveying and other services	16,700.00
Total	826,300.00

[1] Includes $54,000.00 for liquidation activities.

Under the plan for continued liquidation of this Administration in an orderly fashion the loans and notes receivable are being liquidated as rapidly as possible and the individual rural and urban housing units are being sold to the present occupants on a 20-year basis with the Government's interest fully protected by the deed-mortgage plan.

Receipts from the housing units and sale of lots at the Eleanor Roosevelt and Morel Campos Developments amounted to $474,756, which exceeded maintenance and operation expenses by approximately $248,756. As of June 30, 214 urban and 4,115 rural month-to-month rental agreements have been converted into long-term leases with option to purchase and 1,230 units have been conveyed, with titles vested in urban and rural tenants. In accordance with the liquidation program 5,718 urban and rural units were sold under the deed-mortgage plan.

The sugar cooperatives, "Asociacion Azucarera Cooperativa Lafayette" and "Cooperativa Azucarera Los Canos," had a successful grinding year. Lafayette ground 309,272 tons of sugarcane and Los Canos 329,359 tons. In all probability both cooperatives will grant a substantial bonus to their members as a result of their successful activities.

Eighty-five rural houses were constructed, thereby supplying better homes for that number of underprivileged families in the coffee and tobacco areas. About 245 acres of land were developed at the same time for the cultivation of minor crops.

For the purpose of keeping private construction in line with and equal to Puerto Rico Reconstruction Administration construction, and in accord with general policies pertaining to the Eleanor Roosevelt

Development, inspection and approval was given to plans for the construction of 282 new houses. The community housing projects sponsored by the College of Engineers and the Federation of Employees of the insular government, all of which are situated on parcels of land adjacent to the Eleanor Roosevelt Development, were sold for private home construction.

Essential projects for the fiscal year 1952 are being continued with allotments aggregating $745,200 out of the revolving fund. That fund, deriving exclusively from PRRA operations, had a net available balance on June 30, 1951, of $2,970,280, of which $749,706 was collected during the fiscal year.

VIRGIN ISLANDS

Public Works Program

Supervision of the Virgin Islands public works program was transferred to the Office of Territories just prior to the end of the fiscal year. The projects that were given priority by the authorizing legislation (Public Law 510, 78th Cong.), with the exception of the public markets and the malarial-control projects, have been completed or are well under way. Other provision was made by the territorial Government for the public markets and malarial-control projects.

Work on the sea wall and the telephone system is progressing.

Accordingly, attention turned to the hospital and school aspects of the program. Health surveys were made and plans and specifications prepared. Bids have been requested on 4 hospitals, 1 of 116 beds on St. Thomas, 1 of 4 beds on St. John, 1 for 60 beds at Christiansted, St. Croix; and 1 of 12 beds at Frederiksted, St. Croix. Bids have been invited also for construction of two catchment areas to supply potable water on St. John. Contracts will be awarded to the extent of available funds.

Although no construction funds were available for schools, preparations were made for the initiation of a school construction program as soon as funds are appropriated. These preparations took the form of curriculum and construction surveys made by a private consultant and by consultants of the Office of Education of the Federal Security Agency. The conclusions reached as a result of these studies will serve as a basis for determining the type and location of the buildings necessary and architectural contracts will be negotiated to carry out such determinations.

A survey is also being made for a centerline road on the Island of St. John since at present the only method of travel from one end of the island to the other is by boat.

The Virgin Islands Corporation

The Virgin Islands Corporation is a federally-chartered Corporation, the purpose of which is to promote the general welfare of the people of the Virgin Islands through economic development.

The growing of sugarcane and the production of raw sugar by the Corporation continued to be its major activity. The sugar operation is the largest provider of jobs and producer of income. At its peak of operation approximately 1,000 people are employed. It also provides the only market for the sugarcane produced by 650 small farmers. The sugar crop for the 1951 season proved a disappointment. A 14,000-ton crop had been expected earlier in the season but a 5-month drought cut this to 8,000 tons. Several hundred acres of cane that had been planned for cutting did not mature sufficiently to justify harvesting and was permitted to remain in the field for harvesting early in the 1952 crop season. In spite of the severe drought, the 1951 crop was almost double the average production prior to the development of improved cane culture practices started a couple of years ago.

Under a newly established credit program, three types of loans were made. Crop-production loans were available to small farmers who were unable to obtain credit from any other source. These loans were generally used for the purchase of seed, fertilizer, weed spray, insecticides, and machinery hire. Loans were also available for pasture improvement and water conservation work, the proceeds of which were used for the rental of heavy agricultural equipment for brush clearing, contouring, and dam construction; for fencing, and for pasture grass seed and fertilizer. A number of loans were made for commercial development in cases where the proposal appeared sound and credit was not otherwise available. Because of the limited funds available to the Corporation for commercial loans, a maximum of $10,000 on any loan and a 5-year repayment limit was established.

The Corporation made its heavy agricultural equipment available to farmers on a rental basis. Bulldozers, tractors, contour plows, brush cutters, and other farm machinery, not otherwise available in the island, contributed materially to increasing crop production, pasture improvement and development, and water conservation work.

The small dam construction program started by the Corporation last year was continued and two new dams were built impounding 25,000,000 gallons of water. These were constructed at a cost of $8,800 and proved their value during the last drought. While the water impounded was insufficient to provide for any extensive irrigation of sugarcane, the water was used in the operation of the sugar mill and was also used by many small farmers for domestic purposes and for watering their subsistence gardens.

Extension of Social Security

The Old Age and Survivors Insurance and Public Welfare benefits of the Federal Social Security Act were extended to the Virgin Islands under Public Law 734 of the Eighty-first Congress. The latter benefits make possible Federal financial participation in the costs of assistance to needy persons and related administrative costs for four programs, old-age assistance, aid to the blind, aid to dependent children, and aid to the permanently and totally disabled. Federal grants cannot exceed $160,000 to the Virgin Islands in any fiscal year. The funds thus made available will materially improve public assistance standards in the Virgin Islands where the average monthly payment per family has been only about $5. The Social Welfare Department has had the consulting assistance of a public assistance specialist in its preparations for complying with the requirements of the Social Security Act.

Vocational Education

Under the provisions of the Vocational Education Act of 1945, which has now been extended to the Virgin Islands, a new program is being developed to fulfill urgent training needs. The Division of Vocational Education for the Government of Puerto Rico visited the Virgin Islands for the purpose of making a brief review of vocational education activities. A group of consultants from the United States Office of Education made a study of education, including vocational education, in the Virgin Islands and submitted their report to the Governor in November 1950. Among other suggestions they recommended the establishment of a Governor's commission on education and an educational study committee, both of which bodies have now been established. The committee has prepared specific recommendations which will be considered during the coming year by the Governor's commission.

Legislation

H. R. 2644, a bill to revise the Virgin Islands Organic Act, was introduced in the Eighty-second Congress. It is contemplated that hearings will be held in the Islands, where the provisions of the bill have been extensively studied and analyzed by civic and political groups. The Virgin Islands community in New York City has been keenly interested in the bill.

Added stimulus was given to industrialization in the Islands by enactment of Public Law 766, approved September 7, 1950. Existing law provided that articles the growth or product of the Virgin Islands might enter the United States free of customs duty unless they contained foreign materials representing more than 20 percent of their value. This had been interpreted as requiring the taking into account of all foreign materials, including those which might have entered the United States directly in a duty-free status. Tortoise shell from the Philippines might enter the United States duty-free, but if brought into the Virgin Islands and made into buttons there, the buttons would be dutiable on their entry into the States. This obviously discouraged establishment of industry in the Islands. Public Law 776 provides that in determining whether an article contains foreign material to the value of more than 20 percent no material shall be considered foreign which could be imported into the United States duty-free.

Tourism

Progress was made in the expansion of facilities for the tourist trade with the completion of two new hotels in St. Thomas and the opening of several smaller hotels and guest houses in both St. Thomas and St. Croix.

The Virgin Islands Corporation provided $15,000, on a matching basis to sums contributed by private interests and by the municipalities, for tourist development and promotion. The tourist and vacation trade has increased remarkably since the end of World War II and holds great promise for improving the difficult economic situation in the Islands.

PACIFIC TERRITORIES

The Department strongly urged admission of Hawaii into the Union as a state, and had the Congress enacted statehood legislation, this would have been the most significant achievement in the Pacific territories during the year under review. However, failure of the Congress to conclude action on statehood legislation casts the emphasis on the great strides made in Guam, American Samoa, and the Trust Territory of the Pacific Islands. The enactment of organic legislation for Guam and the establishment of civilian administration in Guam, American Samoa, and the Trust Territory of the Pacific Islands, which were accomplished during the past year, are events of historic importance and represent significant advances toward self-government. These measures, which form part of the President's civil-rights program, will have far-reaching benefits not only to the island peoples concerned, but also to the international prestige of the United States and the defense effort.

Hawaii

Statehood continued to be the most pressing need of the Territory of Hawaii and was strongly emphasized in the inaugural address on May 8, 1951, by Oren E. Long, who was appointed by the President to succeed Ingram Stainback as Governor of Hawaii.

Failure of the Senate in the Eighty-first Congress to vote upon statehood legislation after the House and Senate Committees on Interior and Insular Affairs had approved such legislation was a great disappointment to the people of Hawaii and to supporters of statehood throughout the country.

Early in the Eighty-second Congress, the Senate Committee on Interior and Insular Affairs again reported out statehood legislation (S. 49) after determining that further hearings were unnecessary. The bill is endorsed by a majority of members in both parties, and in both Houses. Hopes are strong that it will be brought to a vote in each House during the present Congress.

The Territory itself took the last move within its own power to achieve statehood. On July 22, 1950, the Constitutional Convention of Hawaii, after almost 4 months of work, agreed upon a constitution for submission to Congress. At the November general elections in a record turn-out, the people of Hawaii gave overwhelming approval to the document, which has been widely applauded as a forward-looking and practical state constitution.

The economic situation in Hawaii was markedly improved over the previous year with unemployment falling from 30 percent of the labor force to a low of 5.6 percent on May 1. The bulk of the remaining unemployed persons are unskilled workers, who are difficult to place without additional training because of technological developments in the Territory's industries. There is now in Hawaii a very tight market for skilled workers, and shortages have occurred in selected instances. Likewise, housing, transport, and community facility shortages exist on Oahu. There has been a rise in the Federal employment of civilian workers in military and naval activities, as well as increased employment in the construction and tourist trades. Employment in Hawaii is, however, far from stable due primarily to variable demands of the military establishment and to the threat of strikes in the Territory's industries and in trans-Pacific shipping operations.

The occurrence of strikes was relatively low in the Territory during the past year. Only two serious ones occurred. The Honolulu Rapid Transit strike involving nearly 500 workers lasted for a month in December and January; the pineapple crop on Lanai was endangered by a strike of 800 workers which began on February 1 and was still unsettled as the year under review ended.

The Territorial Government and private business made notable progress in analyzing the Territory's economic problems and in devising sound methods to cope with them. The Department contributed to this economic planning through a Water Resource Investigation conducted by Assistant Secretary Warne. Five public hearings were held at various points in the Territory and over 60 witnesses were heard. At year's end, the Assistant Secretary was ready to issue his report, recommending that more intensive investigation of Hawaiian water resource development, utilization, and conservation be made, with particular attention directed to irrigation projects.

New Responsibilities in the Pacific

Guam and American Samoa have been possessions of the United States since 1898 and 1900, respectively. Until their transfer to the jurisdiction of the Department, they were governed by the Navy Department under authority granted in separate Executive orders. Naval officers served as the governors of Guam and as the governors of American Samoa and were vested with full executive, legislative, and judiciary powers.

The Trust Territory of the Pacific Islands came under United States jurisdiction as a result of World War II. In 1947, by agreement with the United Nations, the United States assumed administrative responsibility for the islands formerly held by Japan under a League of Nations mandate. This area likewise was governed by the Navy under terms of an Executive order, and the commander in chief of the Pacific Fleet served as high commissioner of the Trust Territory.

On October 20, 1945, President Truman established a committee of the Secretaries of State, Army, Navy, and Interior to make recommendations to him on the future administration of the Pacific islands. Twenty-one months later, on June 18, 1947, this committee recommended that organic legislation for each of these three territories providing for government under law, be submitted to the Congress and that steps be taken at the earliest practicable date to effect the transfer of administrative responsibility for the islands from the Navy Department to a civilian agency to be designated by the President.

On February 11, 1948, President Truman declared his intention of transferring jurisdiction over the islands from the Navy Department to the Department of the Interior. On May 14, 1949, he requested the Secretary of the Interior to take the initiative in drawing up plans, for submission to him by September 1, 1949, providing for the transfer of Guam within 1 year and of American Samoa and the Trust Territory within 2 or 3 years.

Those plans, submitted in the form of memoranda of understanding between the Navy and Interior Departments, set July 1, 1950, as the target date for the transfer of responsibility for Guam, and July 1, 1951, as the date of transfer for American Samoa and the Trust Territory. These memoranda, which were approved by the President, set forth the procedure for the replacement of naval personnel by civilians, the arrangements with respect to transfer of property, and the necessity for providing regular air and sea transportation services, other than naval, after the transfer date.

The fiscal year 1951 actually brought to completion all of the transfer arrangements.

On August 1, 1950, the transfer to the Interior Department of responsibility for the administration of Guam became effective in accordance with Executive Order No. 10137, of June 30, 1950. Also on August 1, 1950, Congress enacted the Organic Act of Guam, which established the island as an unincorporated territory of the United States and provided local powers of self-government through an elected legislature, an independent judiciary, and an executive branch headed by a governor appointed by the President.

On June 29, 1951, the President signed Executive Orders No. 10264 and No. 10265, which transferred responsibility for American Samoa and the Trust Territory, respectively, from the Secretary of the Navy to the Secretary of the Interior, effective July 1, 1951.

These acts were made possible only through the efforts of many people, including members of Congress who held hearings in Washington and in each of the territories, representatives of the Departments of the Interior and Navy who worked tirelessly to negotiate and carry out transportation and other agreements by which the islands were to be administered after the transfer date, and public spirited individuals and organizations.

In a statement issued to the press on June 29, 1951, President Truman stated:

> The establishment of civilian administration in these island areas is an historic event. It conforms with a long-established American tradition of conducting the affairs of civil populations under civilian authority. It is one further step in the extension of additional civil rights to the Island territories under our jurisdiction. * * * It is a matter of particular satisfaction to me that this transfer of responsibility has been worked out in a planned, orderly manner, in which the Department of the Navy and the Department of the Interior have collaborated through administrative agreements. These agreements, embodied in memoranda which were approved by me, will assure the people of the islands concerned of the continuation of their essential services, and will assure the people of the United States of the greatest possible economy and most efficient administration.

The sections which follow treat more specifically with the progress made in each area during the year under review.

Guam

The government of Guam has been completely reorganized during the year by the establishment, under the Organic Act, of independent executive, legislative, and judicial branches. The Honorable Carlton Skinner, who had been appointed by President Truman in September 1949, continued to serve as the first civilian Governor of Guam, after reappointment by the President and confirmation by the Senate.

Nine executive departments were established. Pursuant to section 9 of the Organic Act, all heads of executive agencies and instrumentalities were appointed by the Governor "with the advice and consent of the legislature," and in making appointments and promotions, preference was given to qualified persons of Guamanian ancestry. Three important territorial departments, the Department of Agriculture, the Department of Commerce, and the Department of Education, were headed by Guamanians.

In order to establish an adequate territorial civil-service system, the Department of the Interior, in consultation with the Government of Guam, contracted with the Public Administration Service of Chicago to study and recommend a personnel classification and pay plan and to draw up a retirement plan for Guam Government employees. These studies, along with a study of the structure and administration of the revenues of the Government of Guam, were made possible through an allocation from the President's Management Improvement Fund.

Guamanians responded quickly and enthusiastically to their new responsibilities of self-government. A 21-member Legislature was elected in November, and a special session was convened the next month. One of their first acts was to adopt, with certain amendments, the recommended uniform classification and pay plan, thereby abolishing the dual system of payment that had obtained for more than 50 years. A second act of major importance repealed customs duties on goods entering Guam, thereby establishing a free port.

Throughout the year, emphasis was placed on increasing Guam's importance as a center for world trade. Since the military continued to hold 34 percent of the land for defense purposes, Guam could not go back to a strictly agricultural economy. Furthermore, Guamanians in restaurant, retail store, and other businesses had found it profitable to service the some 30,000 non-Guamanians attached to the military forces on the island. Toward the end of the year Guamanian merchants began to stock retail goods with a view toward relieving ships' stores and other military activities of the need to carry supplies for civilian employees of the defense forces. Guam's role as economic center for the Trust Territory and as a port for trans-Pacific airlines and shipping companies expanded. A commercial port was established and plans were laid for the construction of Guam's first privately operated hotel.

Two important institutions formerly operated as a part of the government completed their first year of successful management under private ownership. They are the Guam branch of the Bank of America and the Guam Daily News. The latter had been purchased by a Guamanian in June 1950. Through it, for the first time in the history of American administration of Guam, the Territory had a completely free and independent press—a vital adjunct of self-government.

Agricultural improvements were strongly encouraged through the Territorial Department of Agriculture. An Office of Land Management was established by the Governor to facilitate resettlement of Guamanians who were dislocated by the war and by subsequent acquisition of land by the military for purposes of defense. On October 30, 1950, certain public lands previously administered by the Navy Department were transferred to the Department of the Interior by Executive Order No. 10178. In addition to serving public needs, these lands will be made available for settlement by dislocated Guamanians. Early in the year the Bureau of Land Management of the Department made a study and issued a report on Land-Use Conditions and Land Problems on Guam, which serves as a guide both to the Department and to the Territorial Government in planning land administration.

Plans were completed for a new permanent hospital to replace the temporary buildings constructed during and after World War II. Sketches likewise were drawn for concrete buildings to replace the elephant quonsets being used for the high school. Although some new homes and businesses were constructed during the year, the housing shortage was critical. Toward the end of the year the Housing and Home Finance Agency agreed to make a survey on Guam to determine what Federal assistance might usefully be given the local housing program.

During fiscal 1951 the Congress appropriated $1,250,000 as a grant to the Guam Government. This amounted to a reduction of over $2,000,000 in the cost to the Federal Government for civil government on Guam in previous years. Income-tax laws became effective on January 1, 1951. Continued collection of such taxes for deposit to the account of the Guam treasury will remove the necessity for Federal appropriations with which to operate the Government of Guam in future years.

Paul D. Shriver, of Colorado, was appointed the first judge of the District Court of Guam. In accordance with the Organic Act, which provides that the structure and operation of the courts of Guam, other than the District Court, shall be prescribed by the laws of Guam, a tudy was initiated to guide the local judiciary and the legislature on methods of improving the court system.

Federal agencies, including the Office of Price Stabilization, the Department of Justice, and Selective Service opened Territorial offices in Guam. The establishment of compulsory military service was welcomed by the Guamanians as a necessary corollary to the privileges of American citizenship. At the request of the Governor of Guam and the Department, the Army and Air Force established recruiting facilities on Guam. Work was initiated by the Department o encourage other Federal agencies to extend their services to Guam. n some cases, the Governor carried out functions for other Federal gencies. These included, for example, passport functions for the State Department and export-licensing controls for the Commerce Department.

As authorized and directed by section 25 (c) of the Organic Act of Guam, the President last year appointed a seven-man commission under the chairmanship of former Congressman J. Hardin Peterson of Florida, to review the field of Federal laws and to recommend to he Congress not later than August 1, 1951, which laws applicable to Guam on August 1, 1950, should be declared inapplicable and which aws not applicable on that date should be made applicable. Three of the Commission members were residents of Guam. At the end of he fiscal year, the Commission's report was being completed for transmittal to the United States Congress.

In summary, many major developments of far-reaching significance took place last year with respect to the status of Guam and its people. Most important, in the tradition which prevails for other American Territories, Guam achieved the right of self-government under organic law and the affairs of the civil populace, formerly conducted by military personnel, were placed in the hands of civilians.

American Samoa

During the fiscal year, arrangements were completed for the transfer of administrative responsibility for American Samoa from the Navy to the Interior Department on July 1, 1951. Close cooperation between the two departments brought to a satisfactory solution the problems associated with the transfer. These problems arose primarily from the close interrelationship of the naval base and the civil government, in terms of personnel, property, and services. The closing of the naval bases plus the disestablishment of the Fita Fita Guard added economic difficulties to the transfer problems.

American Samoa, which was acquired under the Treaty of Berlin of 1899, consists of seven islands having a total land area of 73 square miles. Its population, consisting of 18,000—almost all Samoans—are dependent for their livelihood on subsistence agriculture and commercial sale of copra and handicrafts. Opportunities for expansion of production are limited and the loss of income from employment at the naval bases will be a serious blow to the economy.

In preparing for the transfer, a study was made of the organization of the existing naval administration through a grant from the President's Management Improvement Fund, and recommendations for the future civilian administration of American Samoa were included in a report of the study issued by the Department in January 1951. This report served as the basis for preparing the fiscal 1952 budget request and for evaluating organizational and other changes required under the new civilian administration.

Replacement of naval personnel by qualified civilians was one of the first steps in the transfer. The President appointed Mr. Phelps Phelps, of New York, as Samoa's first civilian Governor. On February 23, 1951, he was inaugurated in ceremonies at Pago Pago. The policy of the Department, with respect to American Samoa, was set forth in a letter from Secretary Chapman to Governor Phelps which was read at the inaugural ceremonies. The Secretary stated in part:

> On your Inaugural Day, I hope you will make it clear to the Samoan people that civilian administration and organic legislation are designed to protect their interests and promote their welfare. The submission of organic legislation will be withheld by the Department of the Interior until you have had an opportunity to consult with the Samoan people, and are familiar with their wishes and their needs. In particular, I want the people of Samoa to have my personal assurance that their traditional rights and lands will be protected while, with their help, the civilian administration finds ways to promote their political, economic, and educational advancement.

In accordance with Departmental policy, the Governor has given preference to Samoans in government employment. Stateside or Hawaiian civilians were recruited to fill only those positions for which Samoans were not qualified either by training or experience. At present, 92 percent of the government employees are Samoans.

The new Samoan Government was charged with providing an effective civilian administration and with the promotion of the economic and social welfare of the Samoan peoples at substantially lower costs than the naval government. At the same time, it faced rising prices and prospective wage increases.

High on the Department's list of measures required in American Samoa is the enactment of organic legislation which would provide effective separation of the executive, legislative, and judiciary powers; a bill of rights; and special protection of Samoan land and other rights, essential to the welfare of the people. Means must be found immediately to provide new sources of income for Samoans. Unless they are found or additional Federal aid is granted, it will be difficult for the civilian administration to insure that previous standards of living and of public services will be maintained.

Trust Territory of the Pacific Islands

The transfer of the Trust Territory of the Pacific Islands (former mandated Marshalls, Carolines, and Northern Marianas) to civilian administration involved problems of much greater magnitude and complexity than the transfer of American Samoa. The Trust Territory consists of 96 islands and atolls scattered across 3,000,000 square miles of ocean with a combined land area of 687 square miles. The population of the area in 1950 totaled approximately 55,000. Eight distinct languages are spoken, and island groups vary from the people of the Yap area, almost untouched by modern ways of life, to the highly westernized people of the Northern Marianas. These factors of remoteness, isolation, and cultural differences, together with the war's destruction of governmental facilities, created problems of recruitment, sea and air transportation, and radio communications unique to this area. Furthermore, in view of the far-reaching obligations toward the local inhabitants assumed by the United States under the Charter of the United Nations and under the trusteeship agreement with the Security Council, every step in the transfer had to be conceived with particular care to insure that public services were not impaired in the transfer process.

It was apparent from the earliest stages of the transfer that replacement of the Navy's 16 ships and 7 airplanes providing transportation services for the civil government and the local inhabitants would be our most difficult task. Based on a survey made by the Department with the cooperation of the Navy Department, the CAA, and several private shipping firms and airlines, a plan was recommended to the President for operating seven naval vessels (one AK and six AKL's) and four Navy amphibious planes (PBY–5A's) under contract with private firms. The plan was approved by the President, and on the basis of competitive bids contracts were awarded to the Pacific Micronesian Line, a subsidiary of the Pacific Far East Line, and to Transocean Air Lines to operate these services. As the total estimated cost of these contracts is $1,600,000 annually, the savings to the Federal Government resulting from replacement of naval with commercial transportation services will exceed $2,000,000 each year.

In order to determine personnel and budgetary requirements under civilian administration, a management improvement survey of the Trust Territory government was made by a team of departmental and private experts. The report of this survey, published in January 1951, served as the basis for budget requests, personnel recruitment, and administrative and policy planning. The survey pointed the way toward savings of over $1,000,000 in the annual operating costs of civi government and of over $15,000,000 in the cost of public works construction. Under the recommended organization, only 284 statesiders were deemed to be necessary to replace the 467 naval officers and men serving in the Territorial Government.

On January 3, 1951, the President appointed the Honorable Elbert D. Thomas, former United States Senator from Utah, as the first Civilian High Commissioner of the Trust Territory. The recruitment of civilians to serve in professional and technical posts for which the local inhabitants were not yet qualified, posed challenging problems. Persons had to be found who were technically qualified and who, with their dependents, were able and willing to live in small, isolated island communities and to work with people of a different racial origin and culture. Furthermore, recruitment had to take place when available professional and skilled workers were scarce. Over 2,000 applications which the Department had accumulated mostly through selected solicitation, were screened and appointments made. About 50 naval reserve personnel with training and experience in the Trust Territory were transferred to civilian status in the Territorial Government.

A critical shortage in applicants for medical positions in Guam and American Samoa as well as the Trust Territory was anticipated during the earliest stages of the transfer process. This shortage was overcome by having a naval officer on loan to the Department visit displaced persons camps in Europe and make selections from among the top physicians for employment in the Pacific area.

Another difficult problem was the continuation of subprofessional medical and dental training for about 65 Trust Territory students. To continue the Navy operated schools at Guam required employment of professional civilian instructors. The salaries of these instructors, along with other school expenses on Guam, would have cost the government over $3,000 per student annually. The Department learned that the tuition and living cost per pupil at the Fiji medical and dental schools was only about $440 per year, and after satisfying itself that the quality of instruction compared very favorably with that of the Navy schools at Guam, arranged with British authorities for the enrollment of the students at the Fiji schools.

Naval radio stations at the six district centers had to be manned by civilians, call signs and frequencies assigned, schedules worked out, and relationship with the Navy radio station at Guam for onward forwarding of official and private messages defined. Because of its military interest in weather and other reports from this area, the Navy released some of its communicators, who desired to remain in the area in civilian status, and also agreed to supply radio parts on a reimbursable basis.

Arrangements also were made for the Weather Bureau to maintain weather reporting stations in four district centers, for the United States Post Office to establish post offices in all six centers, for the Coast Guard to maintain aids to navigation where necessary, and for the General Services Administration to purchase supplies and other materials in the United States for the government of the Trust Territory.

The Trust Territory headquarters which the Navy maintained at Pearl Harbor had to be moved from the naval reservation. While the headquarters must be located within the Trust Territory at the earliest practicable date, the establishment of facilities in the area had to be postponed due to lack of funds and other complications. Instead, two former Army buildings at Fort Ruger in Hawaii were reconditioned and the headquarters was moved there. Maintenance of the headquarters staff in Honolulu is both costly and inefficient, and as soon as funds are available the headquarters will be moved to a site within the Trust Territory, in accordance with recommendations of the trusteeship council.

As a basis for concluding transfer arrangements and defining the relations between Navy and Interior Department activities in the Trust Territory, a detailed agreement was negotiated by the two Departments and placed in effect on July 1, 1951. This agreement covered the transfer of property, personnel, communications, security controls, and related matters.

These are examples of the major tasks which had to be accomplished in order to replace naval with civilian administration in an orderly manner. But this is only the beginning and there remains the very difficult job of establishing a government in the area with facilities and programs which will lend fullest credit to the United States in the United Nations and among people throughout the world. Dilapidated quonset houses for employees, makeshift hospitals and schools in some centers, worn-out power and refrigeration plants, and other temporary structures must be replaced by permanent facilities. Until adequate facilities are established, a disproportionate amount of money and personnel must be devoted to keeping the worn-out structures in repair.

The United States has increased measurably its national security by assuming jurisdiction over this area. It would be foolhardy indeed if through false economy we fail to measure up to our obligations toward the people of the area. The investment required of the Federal Government in order to maintain enlightened programs in the

Trust Territory is negligible compared with the good will to be gained among the islanders concerned and among the peoples of the United Nations.

In a letter to the High Commissioner on the occasion of the transfer, Secretary Chapman set forth general policy guides for the administration of the Trust Territory. He wrote:

> This Department will dedicate itself to the principle that the interests of the indigenous inhabitants are paramount, subject only to the requirements of international peace and security. It will foster the maximum practicable participation by the indigenous inhabitants in their own governmental, social, and economic affairs. It will encourage scientific research and particularly the use of applied science in the development of policies and programs in consultation with the islanders. The Department will apply in the Trust Territory the knowledge it has gained from its long experience in promoting the welfare of our Territorial populations and the conservation and development of natural resources toward the fulfillment by the United States of its international trusteeship obligations.

Other Islands

Further progress was made toward conclusion of an agreement on the details of the joint United States-United Kingdom administration of Canton and Enderbury Islands. The outstanding development in these islands was the increased production of fish for markets in Hawaii. The fish are frozen and flown to Hawaii. A survey is under way to determine the need for regulations to insure conservation of fishing resources in the lagoon.

Under arrangements with the Coast Guard, Howland, Jarvis, and Baker Islands were visited. The Department also consulted with the Department of State on administrative matters relating to Pacific island possessions of the United States which are claimed by other governments.

Division of Geography

Meredith F. Burrill, Director

THE DIVISION OF GEOGRAPHY was established to discharge the duties of the Secretary of the Interior with respect to the act of July 25, 1947, which established the Board on Geographic Names. The Division performs research and other staff functions relating to the standardization of geographic names.

Virtually all the 1951 work concerned foreign areas, Alaska, and Antarctica. Geographic and linguistic research preceded standardization of about 125,000 foreign names, including more than 2,500 individual decisions; tabulating machine cards were punched for about 150,000 standardized names; more than 230,000 names were edited on maps and in text for correctness of spelling and accuracy of application; and 15,000 place-name inquiries were answered. Except for name editing, these data represent substantial increases over 1950. Extensive research in Antarctic names was brought near completion. Technical experts of the Division investigated geographic name problems in southern Asia and the Pacific.

Cooperation with State name organizations, which holds great promise for the economical standardization of domestic names, was curtailed due to a lack of funds for the Division's part of such work.

United States Board on Geographic Names

THE BOARD ON GEOGRAPHIC NAMES is an interdepartmental organization established for the purpose of standardizing geographic nomenclature for use by the Federal Government. Representatives of 11 Federal departments and agencies make up its membership. S. W. Boggs, Department of State, was chairman during the fiscal year 1951.

The Board and its committees held frequent meetings during the year to act on policies, names, and related matters. The volume of the Board's activity is reflected in the statistical data included in the report of the Division of Geography.

The Board issued cumulative decision lists for Yugoslavia, Bulgaria, and the U. S. S. R., intensive coverage lists for St. Lawrence Island, Alaska, and Isla de Culebra, Puerto Rico, and Supplement No. 2 to Special Publication No. 86, The Geographical Names of Antarctica, containing names passed by the Advisory Committee on Antarctic Names. Standardization and promulgation of domestic names halted after August because no funds were appropriated for this work in 1951.

The Advisory Committee on Names in Alaska continued to review and furnish recommendations on Alaskan name problems.

Basic foreign name policies were considerably extended to cover new areas and additional matters in areas previously covered.

Office of the Administrative Assistant Secretary

Vernon D. Northrop,
Administrative Assistant Secretary

REORGANIZATION PLAN NO. 3 of 1950, effective May 24, 1950, established the position of Administrative Assistant Secretary in the Department of the Interior. Vernon D. Northrop was appointed Administrative Assistant Secretary on May 25, 1950. The Office of the Administrative Assistant Secretary was established by secretarial order on August 15, 1950, under the provisions of the Reorganization Plan. By virtue of the delegation of the authority of the Secretary of the Interior in the field of administrative management to the Administrative Assistant Secretary, this office provides integrated direction of the functions of the Department in that field. The office is comprised of the immediate office of the Administrative Assistant Secretary and five divisions, viz, Budget and Finance, Property Management, Personnel Management, Management Research, and Administrative Services.

A report for each division follows:

DIVISION OF BUDGET AND FINANCE

D. Otis Beasley, Director

The Division of Budget and Finance is responsible for the general direction and supervision of financial and budget functions of the Department. Its responsibility also extends to the investigation of alleged irregularities. It has also taken on the added responsibility for budget and finance functions as related to the defense agencies for which the Secretary has been designated the responsibility under the Defense Production Act of 1950. The organization of the Division consists of the office of the Director and three branches covering budget, finance, and investigations.

The Interior Appropriation Act for 1951 contained appropriations amounting to $630,396,325, which amount was reduced $64,275,000 by the Bureau of the Budget pursuant to section 1214 of the appropriation act. During the year, however, an additional $26,058,500 was obtained through supplemental appropriation acts, making a total of appropriated funds available to the Department of $592,179,825, as compared with $604,742,057 appropriated in 1950 or a decrease of $12,562,232. Of the appropriated funds available to the Department, $910,000 was transferred under the provisions of the Third Supplemental Appropriation Act 1951 to meet part of the cost of operating the emergency defense activities under the control of the Secretary.

The Budget Branch develops the general budgetary policies, devises methods and standards to guide the preparation of budget proposals by the bureaus and analyzes the proposals in relationship to the Department's over-all budget programs. The branch also assists in the presentation of the budget estimates to the Bureau of the Budget and the Congress.

The budget staff has been giving continual attention to the employment of procedures to accomplish unification and simplification of the Department's budgets. Much has been achieved in the uniformity in preparation of budget presentations. Additional budget improvement processes are now under consideration and will be established from time to time as the procedures are formulated.

The Branch of Finance continued to participate actively in the joint program of the Bureau of the Budget, Treasury Department, and the General Accounting Office for improving accounting in the Federal Government. Special consideration has been given to the provisions of section 113 (a) of the Budget and Accounting Procedures Act of 1950, particularly respecting the establishment of effective control and accountability for all funds within the Department. Exploratory work is under way with the view of establishing an internal audit program in the bureaus and offices. A survey of the bureaus and offices has been started for the purpose of determining the adequacy of the present financial control over property and other assets. Departmental regulations have been prepared pursuant to section 1211 of the General Appropriation Act, 1951, to establish a system of administrative control which is designed to (*a*) restrict obligations or expenditures against each appropriation to the amount of apportionments or reapportionments made for each such appropriation, and (*b*) enable the Secretary to fix responsibility for the creation of any obligation or the making of any expenditure in excess of an apportionment or reapportionment.

The Branch of Finance continued to assist and cooperate with the bureaus and offices to improve their accounting systems, particularly with respect to the accounting systems of the Bureau of Reclamation, Bureau of Land Management, Bureau of Indian Affairs, Bureau of Mines, and the Southwestern Power Administration. These activities have been carried on with the cooperation of the Accounting Systems Division of the General Accounting Office.

The Branch of Investigations conducts investigations of complaints of irregularities in the performance of official duties by employees of the Department; investigates the records of guardians of incompetent Indians in cases where information received indicates improper administration in accounting for the estates of their wards; and conducts investigations of other miscellaneous matters for the purpose of obtaining information on which to base administrative decisions. Wherein possible criminal offenses are indicated in the reports, such matters are referred to the Department of Justice for determination of possible institution of criminal proceedings.

DIVISION OF PROPERTY MANAGEMENT

N. O. Wood, Jr., Director

The Division of Property Management was established on December 7, 1949, by Department Order No. 2546, to develop policies, standards, and objectives for the procurement of materials, the management of property and records of the Department.

The procurement and supply phase of the Division's property management activities assumed the additional workload brought about by the Korean War. Matériel shortages, the inevitable result of participation in war, were anticipated by the Department and the Property Management Division has assisted the operating bureaus in obtaining an adequate supply of the matériel to continue necessary programs. Working in conjunction with the defense production and program staffs in the Department, and with DPA, NPA, and OPS, agencies organized as a result of the enactment of the Defense Production Act of 1950, the Division has participated in drawing up the plans for procurement of critical materials and, as the year progressed, represented the Department in the handling of priorities, requirements, and other phases of the matériel problem. In the first phase of the defense program, the Division aided the bureaus and offices in obtaining materials by use of the DO (defense order) rating; advised bureaus of new orders of importance to departmental operations; represented the regular bureaus at meetings where proposed regulations were discussed and in general acted as the liaison between the bureaus and offices and the various defense activities.

As the tempo of defense activity increased, the Division participated in obtaining a statement of requirements for the basic controlled materials (iron, steel, copper, and aluminum) of the bureaus and offices for the balance of the 1951 calendar year. These, and the requests of other Government departments, manufacturers, and other type consumers, constitute the basic demand for controlled materials which must be measured against available supply. Thus the Property Management Division has participated in the orderly transition within the Department of the Interior from a normal to a semi-war economy.

Despite the additional defense workload created by the international situation, considerable improvement occurred in the field of procurement during the fiscal year. The study of the cost of processing purchase orders has resulted in improved and more economical procedures. A continuing effort is being made to reduce the number of purchase orders issued, particularly those purchase orders totaling less than $20 each.

The Division has developed and prescribed a property accounting manual for use by the bureaus and offices of the Department. This manual establishes adequate and uniform procedures for accounting and accountability for all equipment, supplies, and materials under the jurisdiction of the Department. Adequate controls are included in the manual to insure that proper records of such property are kept and that the property is protected, preserved, and utilized for official purposes. The functions of the Boards of Survey and reviewing authorities relating to utilization and disposal of property are particularly emphasized. In addition, the Division collaborated with the Bureau of Indian Affairs in establishing a detailed property management manual for their agency which includes the provisions of the departmental manual.

Department Order No. 2615 established a departmental records management program whose scope and content were immeasurably larger than the somewhat limited program previously in effect. Concrete evidence of the added emphasis on records management was the retirement of more than 2,700 file cabinets of inactive records to Federal records centers, with the subsequent release for other use of more than 14,000 square feet of office space in the Washington headquarters and making available at least 1,000 of the file cabinets for further use. Similar significant gains were effected through increased emphasis on systematic destruction of those inactive records authorized for elimination under general disposal schedules. With the assistance of Records Management Analysts from the National Archives and Records Service, GSA, improved mail procedures have been devised in some of the bureaus and new file manuals have been developed and installed in the Bureau of Land Management and the office of Territories. Similar file manuals are in process of being prepared for the Fish and Wildlife Service, Bureau of Mines, and the Geological Survey. Many of the bureaus, through the efforts of newly designated records management officers, are preparing written instructions for scheduling of records for disposal, both at headquarters and in the field offices.

Other important phases of the work of the Division include liaison with the General Services Administration (GSA); promulgation of directives issued by the Administrator of GSA; delegation and redelegation of the authority of the Secretary on property and records management matters to the heads of bureaus and offices to permit them to operate more effectively; and the review and appraisal of proposed legislation related to the property and records management functions of the Department.

DIVISION OF PERSONNEL MANAGEMENT

Guy W. Numbers, Director [1]

With the Korean War in progress at the beginning of the 1951 fiscal year, an accelerated defense program was initiated and the matter of recruiting personnel properly qualified for the Department's needs became a major problem. With the passage of the Defense Production Act in September 1950, five defense administrations were established under the Department. These defense administrations have grown to approximately 700 employees including nearly 80 top level employees from industry, many of whom are serving under appointments without compensation.

The reorganization of many of the bureaus and offices and the creation of the defense administrations caused unusual activity in the Branch of Classification during the year. In the defense administrations alone 39 positions were allocated to the new grades GS–16, 17, and 18 set up under the Classification Act of 1949. In this connection the Civil Service Commission and the Bureau of the Budget called for a survey of all of the top positions throughout the Government service to determine whether the numerical limitations on these grades should be lifted or extended.

The culmination of the Division's efforts over the past 8 years in organizing, developing, and guiding a wage administration program for the Department was reached in June 1951, when wage fixing authority was delegated to bureau and field levels. This delegation applies to the determination of appropriate wage rates for ungraded employees, primarily those in the recognized trades and crafts positions, within continental United States. Simultaneous with the delegation, general standards and regulations were promulgated for the guidance of the bureaus and offices pursuant to broad policies heretofore established by the Secretary. A noteworthy feature of the delegation order is the inclusion of authority to approve finally wages and ordinary working rules under formal labor management agreements negotiated between administrative units of the Department and employees' representatives.

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[1] Mr. Guy W. Numbers succeeded to the position of director, division of personnel management, upon the retirement of Mrs. J. Atwood Maulding on June 30, 1951.

Parallel with the advances made in wage administration during the fiscal year, additional emphasis has been placed on the development of a broad labor relations program. Considerable progress was made in defining problem areas in this phase of the Department's operations; in reaching conclusions as to the best approach in solving such problems; and, finally, in drafting a tentative program for developing policies and implementing such policies by prescribing standards, controls, and operating procedures. Major considerations in the over-all program are (1) the administration of labor-management collective agreements based on existing policy, and (2) contract matters affecting labor and involving close cooperation with other Federal agencies responsible for the establishment and enforcement of the provisions of labor statutes.

Nearly 8,000 applicants for employment were interviewed by the employment branch during the fiscal year. Probably the publicity attending the buildup for national defense accounts in large measure for this high number. Another factor is the availability of veterans who are finishing their education under the GI Bill of Rights.

What seemed likely at the beginning of the fiscal year to be a surplus of engineers turned into an acute shortage for which little relief is in sight except in renewed efforts to make the most of present staff. The chronic shortage of personnel in the medical and cartographic services continues. Some relief in the latter is being provided by on-the-job training of appointees having less than full qualifications.

Section 1302 of the Supplemental Appropriation Act, 1951, placed restrictions on appointments, reinstatements, transfers and promotions, and required changing Federal employment practices. These restrictions have lessened attraction among applicants for the Government service and retarded full utilization of present personnel by internal changes.

The Interbureau Placement Committee created during the year has been very successful. Designed primarily to facilitate promotion from within the Department by informal negotiation, it has served the further desirable purpose of a forum for the discussion of policies and procedural problems to the advantage of all concerned.

The new performance rating plan was given its first try-out this year. Designed in and for the Department, with a view to improving the supervisor-employee relationships rather than merely to measure performance, it has been simplified in a number of respects. It has only three summary ratings instead of five—Outstanding, Satisfactory, and Unsatisfactory, with Outstanding intended to mean considerably more than the former Excellent. The number of ratable elements was reduced from 31 to 5. Another departure is the provision that performance requirements must be made known to ratees in advance of the rating period.

In October 1950 a separate Branch of Training was established in the Division, combining the functions of the former training section and the departmental management training program. The new branch was assigned responsibility for developing and coordinating training policies and programs with particular emphasis upon management training. A few months later the departmental executive development committee was appointed. This committee has begun to survey various bureau efforts at leadership training as a step towards developing more systematic and effective techniques for identifying, training, and utilizing executive ability throughout the Department.

The departmental management training program has completed its second year of successful operation. The trainee group was made up of ten promising young career employees of the Department and eight new appointees chosen from recent college graduates who gave evidence of management aptitude. The training included 3 weeks of group orientation, weekly conferences, academic work at Washington universities, individual counseling, and a carefully designed series of productive work assignments under competent supervision. Growing interest in the program and the generous cooperation forthcoming throughout the Department indicate that this pattern of training has gained general acceptance.

A review of the first trainee group showed that nearly all trainees had received promotions and were in appropriate positions for gradual assumption of more important staff and operating responsibilities. The Department is thus developing and strengthening its younger management personnel and building towards a reserve of carefully trained and well qualified people for future executive leadership.

Inspection of the personnel operations in the Washington and field offices of several of the bureaus was made to analyze the degree of compliance with the personnel policies and programs of the Secretary, to evaluate their functioning, and to counsel with executives and suggest improvements.

The Department Supplement to the Federal Personnel Manual was improved by the issuance of eight important changes and additions. These included a personnel management program for executives and supervisors, a streamlined grievance procedure, an employee-management guide which outlines what each employee may expect and assurances to each employee, a chapter on conduct that states the principles of good employee conduct and the responsibilities each employee has to the Department and the Federal Government.

A policy statement and streamlined procedure for the separation of employees for the good of the service was issued. The basic policy is to assure absolute fairness, justice, and protection of the employee from arbitrary or capricious removal.

Thirty-six Civil Service Commission inspection reports relating to personnel administration in various Washington and field offices of the Department were reviewed. These indicated that the organizations have benefited through the Commission's inspection service and have attained an acceptable degree of regulatory compliance.

Instructions were issued for the implementation and installation of the basic records and files system for personnel offices, prescribed by the Bureau of the Budget and the Civil Service Commission. As an aid to operating officials throughout the Department the division developed a personnel-records-and-file system for operating officials.

At the close of the fiscal year there were 63,841 compensated employees in the Department, of which 5,717 were in Washington, D. C., metropolitan area, and 58,124 located in the field. Of the total number, 41,973 are clasified by grade under the Classification Act, 19,133 under wage-board procedure, and 2,735 employees of various classes and ungraded. Veterans in the Department now number 26,024. The number of women is 12,847.

There were 322 retirements in the Department during the year, of which 56 were for age, 196 were optional, and 70 were for disability.

DIVISION OF MANAGEMENT RESEARCH

L. Wade Lathram, Director

The Hoover Commission reports, the interest of the public and the Congress in the conduct of executive activities, and the need for administrative adjustments in the light of defense production emphasis have resulted in major efforts to improve the management of the Department. To this end the Secretary reorganized departmental administration to provide a better basis for integrated natural resource development.

Reorganization Plan No. 3 of 1950 made possible the reorganization of the Secretary's office along major purpose lines so as to permit more effective integration of the management of the Department, and to relieve the Secretary of an overwhelming supervisory load. Among other things, the plan raised from two to three the number of assistant secretaries and authorized an administrative assistant secretary. Under this authority the Secretary, in July 1950, designated three program assistant secretaries. The natural resource management task of the Department was considered to be divisible into three major purposes. Therefore, the Secretary designated an assistant secretary for public land management, an assistant secretary for water and power, and an assistant secretary for mineral resources. The bureaus and offices primarily engaged in these activities were assigned to these assistant secretaries for supervision and management. The program assistant secretaries were given authority by the Secretary to supervise and direct the activities in their respective areas.

In keeping with this concept, proper staff facilities were provided in each of these program areas to make it possible for the assistant secretaries to fulfill their responsibilities. These staff facilities consist of a Water and Power Division, a Mineral Resources Division, and a Land Utilization Division, each responsible to the appropriate assistant secretary and encompassing all of the staff facilities required by that assistant secretary to permit him to insure adequate program development, establishment of policies, and supervision of program execution for his area. The previously existing staff facilities were incorporated into these new divisions.

Under Reorganization Plan No. 3, an administrative assistant secretary was appointed. The purpose of this move was to permit integrated direction of the administrative management activities of the Department and to strengthen and balance the staff facilities in this area. The result has been the establishment of five divisions within the administrative management area at the secretarial level under the administrative assistant secretary. These five divisions are Budget and Finance, Property Management, Personnel Management, Management Research, and Administrative Services. This last division incorporates operating administrative functions for the Secretary's office, permitting the remaining four divisions to operate as staff units in their respective fields.

The Secretary needs, however, to assure himself of the development and integration of a total natural resource program. This responsibility was assigned to the Program Staff with the assistance of the field committees.

As the result of all of these actions, the program development and management load of the Department falls largely on the three program assistant secretaries and the administrative assistant secretary. The Secretary is thus left free for major policies and over-all guidance. Additionally, through the facilities of the field committees and the

Program Staff working with the assistant secretaries, he is able to assure interarea coordination on program development and the establishment of departmental objectives and goals. Thus there exists a relatively small key staff to advise the Secretary on major policy problems. At the same time, it is this same staff which is responsible for execution and management of the decisions made by the Secretary.

Another major organizational action taken by the Secretary was the provision of facilities to carry out his defense production responsibilities. The Secretary of the Interior was delegated responsibilities in petroleum, solid fuels, minerals, electric power, and fishery products areas under the provision of the Defense Production Act of 1950 and Executive Orders 10161 and 10200. Within these areas, the defense production responsibilities of the Secretary consist of operations relating to voluntary agreements; priorities, requirements, and allocations; and the expansion of productive capacity and supply, which includes reviewing and making recommendations on applications for necessity certificates for accelerated tax amortization, loans, loan guarantees, commitments to purchase, purchases, and the encouragement of the exploration, development, and mining of critical and strategic minerals and metals. To carry out these responsibilities, five defense administrations were established: Petroleum Administration for Defense, Defense Minerals Administration, Defense Solid Fuels Administration, Defense Fisheries Administration, and Defense Electric Power Administration. Through the establishment of a defense production staff in his own office, the Secretary provided himself with facilities to coordinate defense activities and to advise him on policy matters. The organization and staffing of these activities and the development of operating relationships with the existing agencies of the Department presented major management problems, since it was desirable to utilize to the maximum the existing facilities to fulfill defense production responsibilities. Closely related to this were the significant adjustments required in the operating procedures of the regular bureaus and agencies with the shift in emphasis from normal peacetime programs to defense programs, yet with continued concern for the natural resource development base of the Department's functions. Estimating and expediting of materials requirements, establishing operating relationships with defense administrations within the Department and defense agencies outside the Department, relating long-range programs to the immediate defense requirements, and similar organizational and procedural problems were involved.

Along with these major tasks there was continuing emphasis on the improvement of the total management of the Department. To this end, and with the aid of the President's management improvement fund, a number of specific projects were completed. These included a study of a management review and appraisal system for the Department, a complete evaluation of the organization and management of the Bureau of Indian Affairs, a study of the field service of the entire Department, and a series of studies required to provide adequate management of the Pacific areas transferred from the Navy to Interior.

DIVISION OF ADMINISTRATIVE SERVICES

Floyd E. Dotson, Director

During the fiscal year this Division continued to furnish housekeeping and other services for which it was established and which are essential in carrying out the work of the Department. These include the operating functions relating to fiscal matters, mail, files and personnel for the Office of the Secretary. Other services provided by the Division and available to all bureaus and offices of the Department include library, museum, health, space, telephone, duplicating, photographic, warehousing and shipping, and printing and binding.

Commencing with the fiscal year a working capital fund, provided for in the 1951 appropriation act, was established for operation of duplicating, telephone, library, supply, and health services. Previously, these services had been provided from funds appropriated to the Office of the Secretary. Under the working capital fund the bureaus and offices pay for services received.

Space for the Department in Washington took on new prominence during the year due to the necessity for providing quarters for defense agencies. Little additional space could be obtained but by means of consolidations, reassignments, and change of usage it was possible to provide for approximately 1,000 additional personnel who were added to the working force in the Interior Building.

Interior Department Museum

Harry L. Raul, Museum Administrator

THE INTERIOR DEPARTMENT MUSEUM was established in 1938 "to visualize to the public the history, aims, and current activities of the Department of the Interior." The more-than-a-century-old history of the Department coincides with a large part of the history and development of the United States. It strikingly illustrates many phases of American history and what is known as the American way of life. In this field, at this time of national emergency, it is noteworthy that the Museum performs a patriotic service along with its nominally technical one as an important Departmental activity in public understanding of the Department's objectives. The effectiveness of the Museum is emphasized by the direct personal contact, on the part of each visitor, with the vast and varied activities of the Department as portrayed through modern visual education techniques.

THE ALASKA SCIENCE CONFERENCE, NATIONAL RESEARCH COUNCIL

Under the auspices of the Secretary, a comprehensive symposium on Alaska was held in the Interior Building during the afternoon and evening of November 10, attended by about 300 persons. Special Alaskan exhibits were displayed in the Museum and in one of the lobbies and in the main corridor. Thirty special panel exhibits were shown in the Museum galleries.

This exhibit was continued for 5 days to accommodate many additional visitors.

ATTENDANCE AND FOREIGN VISITORS

Museum visitors during the past year numbered approximately 32,000 persons. Visitors were recorded in the visitors' register from every State in the Union, and from Alaska, Canal Zone, Guam, Hawaii, Puerto Rico, and the Virgin Islands.

The visitors' register shows registrations during the year from 43 foreign countries: Afghanistan, Argentina, Australia, Austria, Belgium, Bolivia, Brazil, Canada, Chile, China, Ceylon, Colombia, Costa Rica, Cuba, Denmark, Ecuador, Egypt, England, Finland, France, Germany, Greece, Guatemala, India, Indonesia, Ireland, Italy, Japan, Korea, Mexico, Netherlands, Norway, Pakistan, Palestine, Peru, Republic of the Philippines, Russia, Scotland, Sweden, Switzerland, Turkey, Uruguay, and Venezuela.

SPECIAL EXHIBITS

Loan Exhibit From the Secretary

Facsimile of the Constitution of Hawaii, displayed in the office of Territories gallery. This document was presented to the Secretary of the Interior by the President of the Constitutional Convention of Hawaii of 1950, and has inscribed thereon the autographs of all of the signers of this historic document.

Office of the Secretary

Two large hand-tooled leather bound books: Roll-Distinguished Service Awards, and Roll-Meritorious Service Awards, conforming to and supplementing the previously installed Roll-Commendable Service Awards.

Bureau of Land Management

Illustrated color map of Land-use and Activity by the Bureau of Land Management in California, together with paintings, etchings, drawings, and wood-carvings by T. H. Drummond, Cadastral Engineering Division, Bureau of Land Management, depicting scenes from western range country where the Bureau of Land Management operates.

Bureau of Reclamation

Title, More Water and Power for a Stronger America, seven wing, folding panel special exhibit, length 30 feet;

Bureau of Reclamation

Large scale-model of Grand Coulee Dam, first stage of construction, length 9 feet.

ACCESSIONS

A collection of 23 Indian baskets, purchased by the Indian Arts and Crafts Board from Mrs. W. S. Walcott, Jr., Litchfield, Conn., was deposited in the Museum and cataloged as the Walcott section of the Museum general collection.

A collection of 12 Indian artifacts, assembled by the late William McNab Ramsay, and presented to the Bureau of Indian Affairs, was deposited in the Museum and cataloged as the Ramsey section of the Museum general collection.

One set of four historical photographs relating to the Department was deposited in the Museum by the Director of the Division of Personnel Management and cataloged in the Museum general collection.

COLLABORATION WITH BUREAUS

Numerous case installations and revisions were completed during the year including:

National Park Service

Twenty case-wall panel exhibits, in 10 display cases, exhibiting 128 publications illustrating and describing the national parks, national monuments, national military parks, national historical parks, national parkways, national historic sites, national memorial park, national recreational areas, together with a framed panel showing selected national capital parks publications.

Geological Survey

The popular and manually operated exhibit of Microfossils From Texas revised and reconditioned.

Bureau of Indian Affairs

Case exhibit, Indian paintings (from general collection), Hopi Katchina figurines, Sacred Meael plaque, and Navajo Saddle Blanket, example of old-style hard weave (from Gibson collection).

Fish and Wildlife Service

Embryological Series of Coho Salmon exhibit revised and reconditioned, and revised Duck Stamp exhibit.

Office of Territories

Installed large hand-painted flag from Guam.

Bureau of Mines

First-aid instructors' classes were held in the Museum, by the Bureau of Mines, for selected representatives from all of the bureaus. The bureau representatives now have organized bureau classes to continue the courses in the Museum.

COOPERATION WITH OTHER AGENCIES

Consultation and assistance in display programs were rendered, upon request, to number of agencies including, the American University, Federal Security Administration, and the National Museum.

SCHOOL CLASSES AND ORGANIZATION GROUPS

Many school and college classes and organization groups visited the Museum during the year in connection with scientific and conservation studies. These groups were given guided Museum tours. Notable among the groups were the participants in the Division of Personnel Departmental Management Training Program, and, under the same auspices, a group of 21 French industrial management trainees; a delegation from the President's National Youth Conference; a group of 10 foreign students directed to the Museum by the State Department, followed by a group of 5 Japanese foreign office officials. Among the student groups were the Cherokee Indian School, Cherokee, N. C.; the George Preparatory School, George, Pa.; a group of 150 teachers and students from Oxon Hill, Md., Junior High School; a troop of Girl Scouts from Westside Jewish Temple, Chicago; 100 Cub Scouts, Pack No. 240, of Maryland, accompanied by 50 parents and den leaders. For the convenience of this group, the Museum was held open during evening hours.

Many delegates to the Sixtieth Continental Congress of the Daughters of the American Revolution visited the Museum. During the year several visiting groups were received in compliance with courtesy letters from Members of Congress.

MOTION PICTURES

Sound-motion pictures were shown in the Museum, 12 to 1:30 daily. These departmental films were supplied by the bureaus and included such titles as follows: Bureau of Reclamation, Corraling the Colorado; Bonneville Power Administration; Hydro; Fish and Wildlife Service; Conservation in Action; Halibut Fishing on the Pacific Coast; Filleting and Packaging Fish; Hunting the Puma, etc.

INFORMATION SERVICE

Publications furnished by all of the bureaus and kept in stock at the information counter were supplied to visitors, upon request, and to teachers and school conservation classes. Inquiries were answered daily and special assistance rendered when requested or opportunities presented.

Petroleum Administration for Defense

Bruce K. Brown, Deputy Administrator

ON OCTOBER 3, 1950, by Order No. 2591, the Secretary of the Interior established the Petroleum Administration for Defense to administer the defense responsibilities with respect to petroleum and gas delegated to the Secretary of the Interior by Executive Order 10161, pursuant to the provisions of the Defense Production Act of 1950 (Public Law 774, 81st Cong.). The Secretary is the Petroleum Administrator and the activities are directed by a deputy administrator. The organization is patterned after that of the Petroleum Administration for War, modified to fit the added responsibilities of PAD and in recognition of the differences between a world war and a defense mobilization program.

The Petroleum Administration for Defense had the foundations of the Department's Oil and Gas Division upon which to build the agency necessary to carry out the defense responsibilities. The Secretary of the Interior, by Order No. 2602, transferred on December 1, 1950, certain advisory and service functions of the Oil and Gas Division to the Petroleum Administration for Defense.

The first technical problem the new agency dealt with was a shortage in the supply of high octane number aviation gasoline for the military. To assist in the solution of this problem, a small staff of aviation fuels specialists was selected from among individuals who were active in the aviation fuels work of the Military Petroleum Advisory Board. Through the cooperation of the Defense Department and the petroleum industry, this effort resulted in the petroleum industry meeting all requirements of the military services during the fiscal year. Intimately associated with the problem of supplying adequate high octane aviation gasoline was the supply of components for manufacture of synthetic rubber. The two programs were carried on coincidentally because each requires some of the same components.

To evaluate effectively the petroleum situation, it was necessary for PAD to establish promptly a Program Division to formulate integrated short-term and long-term programs for meeting total essential world-wide petroleum requirements of the United States and friendly foreign nations. By December the Program Division, with assistance from the Department of Defense and data available from the Military Petroleum Advisory Board, was determining the probable demand for petroleum and its products under defense mobilization and possible war conditions. From these forecasts, the PAD prepared operating programs to meet the petroleum demand. Operating divisions, such as Production, Refining, and Supply and Transportation, review the present capacity of the various segments of the industry and determine what and where expansion is required to meet the goals set by the Program Division. The operating divisions determine the type of expansion and requirements for critical materials, and likewise allot to the individual operations the controlled materials made available for each particular segment.

By early December 1950, PAD had established a Materials Division to assure that materials and equipment needed for essential construction and operations of the petroleum and gas industries are made available to meet the programs determined to be necessary.

PAD has developed an effective system for the distribution of materials required by the various segments of the petroleum and gas industries. At the request of PAD, the National Production Authority issued Orders M–46 and M–46B, which deal with the use of materials by the petroleum and gas industries and provide the mechanisms whereby the desired quantities of materials needed by the operators in these industries may be obtained. These orders are administered independently by the Petroleum Administration for Defense. Near the end of the fiscal year, the Defense Production Administration, together with the National Production Authority, instituted the Controlled Materials Plan. The Petroleum Administration for Defense, by modifying its orders, geared its priorities activities into the plan.

Under the plan, the Materials Division, working closely with PAD's operating divisions, coordinates requirements for materials needed by the petroleum and gas industries, presents these requirements with justification to the National Production Authority and Defense Production Administration. When the allocations have been made to PAD, the Materials Division assists the operating divisions in the proper distribution of these materials to the individual operators in the industries and assures that authorizations to purchase are within the limitations of the materials available. It also assures operators that materials for which purchases are authorized will be made available.

Positive steps were taken by PAD to coordinate its activities in connection with the production of petroleum and natural gas with those of the appropriate State regulatory authorities by arranging a conference in Washington on January 19, 1951, with representatives from the State regulatory authority bodies of all the oil- and gas-producing States. The conference concerned itself with discussion of procedures to assure the future close coordination of the State regulatory authorities with PAD and with certain problems with respect to the production of petroleum and natural gas.

During midwinter of the fiscal year, a combination of extremely severe cold weather, a rail strike, and the freezing of the Illinois waterways created a serious spot shortage of fuel oils and liquefied petroleum gas in the Chicago and Midwest area. PAD organized a Special Midwestern Emergency Petroleum Fuels Committee, headed by the Director of the Supply and Transportation Division, for the purpose of dealing with this emergency situation on the spot. Through these efforts under the direction of PAD officials action was taken to distribute available supplies so as to avoid the imposition of extreme hardship on defense industries and essential civilian users.

In January, the Supply and Transportation Division undertook a comprehensive study of petroleum transportation facilities to determine present capacities and expansions required under a continuing mobilization economy. This study was nearing completion at the end of the fiscal year.

To assure a continued supply of tetraethyl lead fluid in the event of damage to any of the existing TEL manufacturing facilities, the Petroleum Administration for Defense issued its PAD Order No. 1. It was designed to conserve automotive tetraethyl lead fluid in order to build a reserve supply adequate for the needs of national defense and to enable the output of military grades of aviation gasoline to be expanded. The order which was placed in effect on March 1, 1951, limits petroleum refiners' usage of TEL to a stipulated percentage of a refiner's 1950 usage. The order makes special and separate provision for small refiners so as to minimize, if not wholly remove, any burden that might be placed upon them by the issuance of the order.

Unlike the Petroleum Administration for War, the Petroleum Administration for Defense is charged under the Defense Production Act of 1950 with defense mobilization responsibilities with respect to gas, both natural and manufactured, and particularly the transmission and distribution thereof. To properly handle the responsibility, PAD set up a gas organization, under an assistant deputy administrator. It is composed of three divisions: Gas Planning, Gas Operations, and Gas Facilities, which handle problems involved in transmission and distribution of gas.

In addition to providing the internal administrative machinery to assure successful mobilization of this industry, the Secretary, on

March 9, 1951, established the Gas Industry Advisory Council, to advise PAD on matters of importance affecting supply and distribution of gas under the defense program. This council is representative of all segments of the gas industry and all sections of the country. This is the first time the gas industry has had a national council working with and under Federal Government auspices.

Toward the end of the fiscal year provision was made whereby the PAD would receive directly the advice and counsel of the National Petroleum Council, an industry council established in 1946 by the Secretary of the Interior to furnish advice and information to the Secretary of the Interior and the Oil and Gas Division on petroleum matters of national significance.

The Anglo-Iranian oil crisis, culminating in the shut-down of the world's largest refinery at Abadan and the cessation of tanker movements from Iran, caused serious dislocations in the supply of petroleum normally flowing from that country to friendly foreign nations of the free world. In order to cope with this situation, the Petroleum Administration for Defense sponsored and procured the approval of a voluntary agreement pursuant to the provisions of section 708 of the Defense Production Act of 1950. The voluntary agreement, dated June 25, 1951, provides the mechanism whereby American oil companies operating abroad can, with immunity from prosecution under the Federal Antitrust laws and the Federal Trade Commission Act, take cooperative action designed to compensate for the loss of the Iranian petroleum to the friendly foreign nations. Nineteen American oil companies accepted requests to participate in the voluntary agreement. The same companies were appointed on June 28, 1951, by the Secretary of the Interior and Petroleum Administrator for Defense to membership on the Foreign Petroleum Supply Committee authorized by the voluntary agreement.

The Defense Production Act makes provisions for financial incentives to encourage industry in expanding production. Among these incentives are accelerated amortization, loans, and contracts.

The PAD established an office of finance counselor to advise and assist in determining policies, practices, and procedures with regard to extending the incentives to the petroleum and gas industries.

The policies of the PAD on accelerated amortization have been established to provide the degree of incentive needed to insure construction of the facilities required to fill the petroleum and gas programs. In some branches of the industry, such as production and marketing, accelerated amortization has not been found necessary and has been denied. In other branches of the industry accelerated amortization has been an effective tool and is accomplishing the greater part of the expansion required. In a few activities additional ncentives in the form of defense loans and facilities contracts have een found necessary.

At the close of the fiscal year the Office of Finance Counselor had ormulated policies and criteria for accelerated amortization on (*a*) ew investments in petroleum refineries, (*b*) petroleum storage faciliies, (*c*) natural gasoline plants, recycling plants and similar faciliies, (*d*) production of sulfur or sulfuric acid from natural gas and etroleum refinery gases, and (e) oil pipe lines. One receipt of appliations for Certificates of Necessity from the Defense Production Administration the Office of Finance Counselor sends the applications to the appropriate operating divisions for analysis and recommendation on the basis of the established policies and works with the operating divisions in applying the policies. The Office of Finance Counselor reviews the Reports and Recommendations of the operating divisions for the deputy administrator. At the close of the fiscal year 588 applications had been received, recommendations for accelerated tax amortization were made on 172 cases and 19 cases had been denied.

That significant progress was made in organizing and staffing this new agency to carry out its petroleum and gas defense responsibilities is also indicated by the fact that the deputy administrator with the assistance of five assistant deputies had by the close of the fiscal year established and functioning four staff divisions: Office of Finance Counselor, Administrative, Public Information, and Legal; four service divisions: Materials, Program, Manpower, and Facility Security; 10 operating divisions: Production, Natural Gas Production and Processing, Refining, Supply and Transportation, Gas Planning, Gas Operations, Gas Facilities, Foreign Production, Foreign Refining, and Foreign Supply and Transportation. To attain coordination and cooperation in administration of its defense responsibilities, PAD also established a number of inter-agency and intra-agency committees.

Defense Solid Fuels Administration

Charles W. Connor, Administrator

AMERICA'S VAST COAL resources, even in normal times the primary source of heat and energy for our industrial economy, are being rapidly mobilized by the Defense Solid Fuels Administration to meet the accelerating demands of our defense program.

In the present national emergency, the adequacy and effective distribution of our coal supply is of vital concern to the Nation. Coal generates almost half of our electricity and supplies about 45 percent of our total demand for energy. It is our most flexible source of fuel supply, being capable of rapid expansion in times of need, a characteristic which is of special importance in an emergency period. Industries which are rapidly expanding as a result of new defense requirements, especially the electrical utility industry, are heavily dependent upon adequate and steadily increasing supplies of coal. Our crucial steel expansion program is dependent upon coal since steel cannot be produced without coking coal. In addition, the coking process supplies more than 200,000 chemical products, vital in war and peace, ranging from dyes and solvents to explosives and plastics.

The critical importance of coal in the production of the munitions, guns, tanks, and planes urgently required in our rearmament effort further underlines the important role of coal in our modern economy. The production of a 1-ton bomb, for example, requires the equivalent of 2 tons of coal and manufacture of a modern tank requires the power equivalent to 225 tons of coal.

In cooperation with other Government agencies and the coal-mining industry, the Defense Solid Fuels Administration is working to solve the immediate problems created by the rearmament program and to prevent the development of shortages of solid fuels that would seriously handicap the defense effort. The half-year since the Administration was established on December 4, 1950, has been a period of organization and orientation. Goals have been set, a small but effective staff (totaling 49 on June 30, 1951) developed, and basic activities directed to accomplishing the Administration's mission originated. Since the flow of coal to the consumer is subject to dislocations, particularly in an emergency period, caused by transportation bottlenecks, shortages of essential supplies and equipment, manpower problems, and related factors, the DSFA has focussed attention on these immediate problems.

COAL PRODUCTION

During the first 6 months of 1951 bituminous coal production totaled 266,232,000 tons, an increase of 13 percent over the 1950 production for the same period of 235,508,000 tons. Anthracite production in the first half of 1951 reached 19,871,000 tons, as compared to 22,224,000 tons in 1950. In the 1952 fiscal year, bituminous coal production, with the demand from electric utilities, steel works, and other industrial consumers growing, is expected to rise significantly. The output of Pennsylvania anthracite, used principally for space heating in the northeastern United States and Canada, is also expected to expand, although less markedly.

The expansion of the steel industry will place particularly heavy demands on our output of metallurgical coal. The presently programed expansion of the steel industry is expected to increase the demand for metallurgical coal to about 120 million tons by the end of 1952, an increase of 17 million tons over the 1950 production rate of 103 million tons.

To assure equitable distribution of metallurgical coke in the event that the present tight supply of high-grade coking coals is intensified, the DSFA has established procedures for directing individual shipments of solid fuels where they are most acutely needed, when such procedures are required by the defense program. Under an order issued April 30 (SFO–2), specific directives may be issued for the delivery of solid fuels in individual cases. At the end of the fiscal year, it has not been necessary to exercise these powers and broad control of solid fuels' distribution is not contemplated since the supply of most grades of coal is adequate to meet current demands.

COKE PRODUCTION

One of the most pressing problems facing the Nation in the field of solid fuels is the expansion of coke output to the levels required by the steel expansion program. It is expected that the demand for coke will increase by 13 million tons by the end of 1952 over the current rate of about 72 million tons annually. The problem of meeting fully the demands of the coke industry is intensified by the fact that many ovens now in operation may be retired in the next few years because of obsolescence. During 1950, for example, about 574 new slot-type ovens were placed in operation and 696 taken out of operation, resulting in a net loss in coke capacity for that year. Considerable progress in expanding beehive coke output became evident, however, in 1951 when beehive coke production for the first half of the year totaled 3,710,300 tons, about 88 percent over the 1950 output for the same period of 1,971,300 tons.

Although new coke ovens with a capacity of close to 15 million tons are expected to enter production by the end of 1952, about 5 million tons will be required for replacement purposes, leaving only about 10 million tons of net additional capacity. To overcome the potential deficit of about 3 million tons, DSFA is attempting to stimulate the needed new oven construction, and is assisting the industry in meeting its requirements for materials and manpower.

The distribution of petroleum coke was delegated to the DSFA by the Petroleum Administration for Defense on May 14, 1951. At the present time, there appears to be an adequate supply of petroleum coke for the needs of the aluminum and carbon industries.

TRANSPORTATION

DSFA is engaged in a broad-gauged effort directed to reducing the impact on solid fuels' availability of transportation shortages expected to develop during the winter of 1951–52. Shortages in railroad coal cars have been reported for the past year. While these shortages have not resulted in shut-downs in critical numbers, some mines have closed for short periods because the available supply of open top cars did not warrant continued production. The balance now existing between serviceable coal cars and production which must be moved is precarious, particularly when it is considered that coal cars are used extensively in transporting numerous other commodities. Sharp increases in the tonnages of these commodities, especially strategic minerals, offered for transportation are expected in the 1952 fiscal year. It is estimated that the tonnage of all such commodities to be transported will require an increase in open top car ownership by about 150,000 in 1952 in order to prevent the development of critical shortages in this class of equipment.

A close check is being kept on the availability and need for coal transportation equipment. In supporting the railroad car building and repair program, the DSFA is attempting to assure that the cars used in the transportation of coal are built and repaired in proportion to use made of them, as compared to the use made of all other types of cars. Small gains have resulted from this program, but the supply of these cars in prospect for the winter of 1951–52 will not be adequate to meet all demands.

To cope with this problem, the DSFA is working with other Government agencies, American railroads, and coal producers to take emergency steps to overcome local distribution problems, where this may be necessary. These steps include the use of whatever measures are available to eliminate cross hauls, and indirect routing of loaded cars, as well as the direction of shipments of solid fuels if necessary.

In order to help prevent coal shortages caused by winter transportation bottlenecks, the DSFA has also spearheaded a program of summer fuel buying by Government agencies, industrial consumers, and home owners. The summer fuel buying program inaugurated by the Department of the Interior in May 1951, quickly received the support of other Government departments, fuel producers, and transportation agencies. At the end of the fiscal year, a Nation-wide program of voluntary fuel stockpiling by consumers was being carried on with the backing of many State Governors and was gaining widespread public cooperation.

MATERIALS AND EQUIPMENT

The need for assistance to the solid fuels industry in meeting shortages in the equipment and materials required to maintain and expand production was met by DSFA during the first half of 1951 by spot assistance to individual operators. With the introduction of the controlled materials plan on July 1, 1951, the DSFA will act as a claimant for the solid fuels industry for its over-all equipment and materials needs. Through its representation on various National Production Authority special requirements committees, the DSFA also works out definite programs for obtaining the multiple-end-use equipment required by the coal mining industry. In order to carry out these functions, the DSFA will take appropriate steps to determine the mining industry's material and equipment needs for specified periods.

To facilitate its program of priority and allocations assistance to the coal and coke industry under the CMP, the DSFA was completing, at the end of the fiscal year, a serialization and classification of solid fuels' facilities. On the basis of reports submitted by operators in compliance with SFO–1, issued April 20, 1951, each coal mine, coke plant, and coal and coke preparation and processing plant will be classified according to location, kind and quality of product, productive capacity, and other factors, for this purpose. These reports will also supply useful information in connection with manpower problems, the originating shipping points of solid fuels, and the rated capacity of mines producing various types of coal.

Under its delegated authority to take action on applications from solid fuels producers to commence construction in certain categories, the DSFA has prepared to process such applications and make charges against the allotments of controlled materials made to the Administration by the Defense Production Administration.

MANPOWER

Shortages of skilled workers in the solid fuels industry, due to inductions into the Armed Forces and diversion of labor to other occupations, have been reported. While the effect of such diversions has not yet been critical, steps have been taken to develop the facts more fully with respect to the manpower situation and to make plans for meeting future and more serious shortages that would adversely affect the production of coal and coke.

The Administration has consulted with the defense manpower agencies in the development of policies and criteria to be applied to manpower problems affecting solid fuels. In absence of the need, at this time, for an over-all manpower program, the Administration has assisted segments of the industry in obtaining specific relief in cases involving the induction of key employees. The Administration is also planning an information program to encourage workers in the coal fields to remain in the mining industry.

INDUSTRY FINANCE

The Administration is stimulating increased production of coke and metallurgical coals through financial assistance to producers, principally by the recommendation of necessity certificates for accelerated tax amortization and defense loans to producers. Policies on tax amortization for anthracite, bituminous coal, merchant byproduct coke plants, integrated coke plants and beehive coke plants have been developed.

As of June 30, 1951, the Administration had received 159 applications, totaling $310,498,000, for necessity certificates. DSFA at that time had acted on 85 applications, totaling $167,006,000. Applications totaling $97,619,000 have been approved by DSFA; $24,080,000, disallowed; and $45,307,000 denied. The respective percentages are 58.45, 14.42, and 27.13 percent.

Of the eight applications for loans under the Defense Production Act received during the year, one application has been denied, one recommended to DPA for certification, and one has been withdrawn. The other applications were being examined.

TECHNICAL ASSISTANCE

Under an arrangement with the Bureau of Mines, that agency is providing needed statistical and related assistance to the Administration in obtaining and analyzing coal production and distribution data. Technical assistance has also been provided in examining necessity certificates and defense loan applications, and special reports are prepared on particular solid fuels' problems.

SOLID FUELS' OUTLOOK

No widespread shortages of coal are expected in the winter of 1951–52, although the prevention of spot shortages arising from transportation bottlenecks will demand the full cooperation of the coal and railroad industries, as well as individual consumers. Coal output may have to be expanded rapidly in the 1952 fiscal year, particularly in the second half, to meet new demands arising from industrial conversions to coal from other fuels. Coke supplies will continue to be tight and a continued rapid expansion of the coke industry will be required to prevent shortages that would seriously undermine the steel expansion program.

Defense Electric Power Administration

James F. Fairman, Administrator

FORMALLY ESTABLISHED December 4, 1950, by the Secretary exercising authority delegated to him by the President under the provisions of the Defense Production Act of 1950, the Defense Electric Power Administration is responsible for mobilizing the electric utilities of the Nation for defense production.

In this task it represents approximately 4,000 private and public electric power utilities, including rural cooperatives, having a total approximate worth of more than $25,000,000,000.

As claimant agency for these utilities the Administration is responsible for analyzing and formulating the electric power expansion program of the Nation and procuring adequate materials and equipment to keep the program on schedule. It is also responsible for making recommendations with respect to certificates of necessity for accelerated tax amortization for electric utilities and for carrying out other functions under the Defense Act of 1950.

Preliminary to its formal establishment the Secretary was assisted in organizing the agency by D. L. Marlett, Assistant Administrator of the Bonneville Power Administration and consultants from public and private electric utilities. In addition, Secretary Chapman appointed an Electric Utility Defense Advisory Council of 30 members, representing all segments of the industry, to advise him in carrying out his responsibilities with respect to electric utilities.

On January 4, 1951, Clifford B. McManus, of Atlanta, Ga., president of the Southern Co. and former president of the Georgia Power Co., was sworn in as Administrator of the agency, accepting the appointment by Secretary Chapman with the understanding that he would remain in the office 6 months.

Following Mr. McManus' appointment, Secretary Chapman named Ken G. Whitaker, of the Electric Power Board of Chattanooga, Tenn., and James F. Fairman, vice president of Consolidated Edison of New York, as his deputies.

On the resignation of Administrator McManus, effective June 30, 1951, Secretary Chapman announced the appointment of Deputy Administator Fairman as successor. On September 30, 1951, Mr. Whitaker resigned to return to his duties in Chattanooga and John D. Davis, Washington, D. C., Manager of the Bonneville Power Administration, was appointed to succeed him as Deputy Administrator by Secretary Chapman.

From the time of its establishment, the Defense Electric Power Administration was confronted with two major problems:

First, implementing a program designed to provide an increase of approximately 27,000,000 kilowatts of electric energy by the end of 1953;

Second, making the entire defense mobilization organization conscious of the fact that there is no substitute for electric power, and any reduction in the materials and equipment necessary to enable the electric utilities to carry out their objectives, jeopardizes the success of the defense-production program as a whole. This agency has consistently maintained that increased electric power is an indispensable element in preserving national security.

In developing its program, DEPA has taken the following effective steps:

Investigated the power situation in all major electric-power systems and interconnected power networks as to prospective power loads and scheduled expansion of power facilities;

Coordinated information on power requirements of defense projects between Government planning agencies and power supply systems;

Created reporting procedures which make full information available as to the material requirements of electric utilities;

Established an orderly method of distributing scarce materials, such as aluminum, copper, and steel, among electric utilities, paving the way for transition on the part of electric utilities to the controlled materials plan;

Developed the criteria with the Defense Production Administration for the review of applications by electric utilities for certificates of necessity for accelerated tax amortization;

Provided expediting services for electric utilities requiring special priorities assistance, securing blanket priorities in several instances for entire projects connected with the Atomic Energy Commission or located in the critical Pacific northwest area;

Effected arrangement with REA for control and distribution of program materials for electric cooperatives, based on Memorandum of Agreement between Secretary of the Interior Oscar L. Chapman and Secretary of Agriculture Charles F. Brannan;

Promoted the increase of electric power in areas of threatened shortage to assure full operation of defense and defense-supporting plants.

Defense Fisheries Administration

Albert M. Day, Administrator

THE DEFENSE FISHERIES ADMINISTRATION was established on December 4, 1950, to discharge the Federal Government's responsibility for the production of fishery products as it relates to the defense effort. This responsibility particularly involves the exercise of priority and claimant functions with respect to materials and facilities required in the production of fishery commodities to meet defense needs.

In the short period the Defense Fisheries Administration has been in existence, it has carried on much the same type of activities as did its counterpart agency, the Office of Coordination of Fisheries, in World War II. Examples of these activities are:

(1) Assisting fishermen and fishery concerns in obtaining sufficient scarce materials and fabricated parts to keep them operating in the production of adequate supplies of fish and fishery products;

(2) Developing, at the request of and for the National Production Authority, data on the requirements of materials and fabricated parts;

(3) Reviewing in advance pertinent National Production Authority orders in process to insure equitable treatment to the fishery industry;

(4) Collecting and analyzing basic data and giving necessary advice and assistance to the Office of Price Stabilization for its development of price ceilings for fishery commodities;

(5) Cooperating with appropriate agencies charged with the administration of manpower policies in the development of standards for deferment of fishery personnel, and making specific recommendations for deferment of key fishery personnel when found to be justified;

(6) Consultation with the five fishery industry advisory committees to obtain guidance in the defense effort;

(7) Developing recommendations for approval or denial of applications for loans and accelerated amortization in connection with fishery production facilities;

(8) Making studies looking toward the allocation of raw fish when and if such allocation is necessary or desirable; and

(9) Making recommendations to the Department of Agriculture in connection with its fishery problems of distribution and container supply.

In addition to a small, streamlined central office staff, the Defense Fisheries Administration has a few offices in important fish producing centers. However, it depends largely for its data collecting, legal, informational, and administrative services upon appropriate offices of the Fish and Wildlife Service.

Defense Minerals Administration

James Boyd, Administrator

THE DEFENSE MINERALS ADMINISTRATION was established by the Secretary of the Interior on December 4, 1950, pursuant to the provisions of the Defense Production Act of 1950, for the maintenance and increase of production of essential and strategic minerals and metals, and for administering a program to stimulate exploration for new sources of such commodities.

On December 5, 1950, the Secretary appointed an Administrator under whose direction the Defense Minerals Administration launched plans for operations within the powers and limitations outlined in Executive Order 10161, dated September 9, 1950, in which governmental actions to increase supplies of essential metals and minerals and action to encourage exploration for new sources were delineated.

A point of processing for each listed mineral and metal up to which the Department of the Interior and the Defense Minerals Administration would exercise priorities and allocation powers was established by a delegation of authority, and beyond this point the National Production Authority exercised such powers. In general, DMA's authority included the mining of the ore, concentrating, and smelting, and it extended up to the point of production of the primary product. For instance, in the case of aluminum, DMA was given responsibility up to and including the production of pig aluminum, but the power to allocate pig aluminum and all subsequent shapes and forms of aluminum remained in NPA. Corresponding divisions of claimant responsibilities with respect to production facilites were also specified.

In the beginning, the Defense Minerals Administration encountered difficulties in recruiting experienced personnel and also had to wait for a clarification of authority in certain instances. Notwithstanding the early obstacles, the agency immediately undertook some basic functions. The first task was to determine the extent to which it was necessary to expand the supply of ores, metals, or nonmetallic minerals over a 5-year period (1951–55) to meet both civilian and military needs without impairing national security. The second job was to recommend means and methods by which such expansion could best be accomplished from the point of maximum use of natural resources, materials, and available equipment and manpower.

To determine the Nation's mineral requirements and supplies, the Defense Minerals Administration correlated available data from the Munitions Board, the National Production Administration, General Services Administration, the Defense Production Administration and the Armed Services to arrive at basic polices for the various commodities involved. With few exceptions, requirements for metals and minerals exceeded the supplies, and following numerous conferences with officials of these agencies and representatives of the industries, a method of "programing" of about 80 critical and strategic materials was devised so that a balance could be arrived at as regards the supply and demand for the 1951–55 period. This programing centered chiefly on finding existing recoverable supplies and prospective sources that could—with or without Government assistance—be relied upon to fill the gap between indicated and calculated requirements and estimated supplies over that 5-year period.

As of June 30, 1951, the Supply Division had completed programing of 16 critical commodities; namely, chromite, tungsten, titanium, copper, magnesium, iron ore, manganese, molybdenum, columbite-tantalite, fluorspar (acid), zinc, cobalt, fluorspar (metallurgical), mica, nickel, and sulfur. These programs have all been approved by the Defense Production Administration. At the end of the fiscal year indications were that although it would not be possible to work out feasible programs for all of the critical commodities, the major portion of them would be completed in the near future. At the same time, changes or revisions in programs would be made to keep apace with changes in mobilization requirements or variations in the supply picture.

On January 2, 1951, the Defense Minerals Administration issued an order prohibiting the hoarding of more than 50 separate scarce minerals which were listed by name in the order. This was followed by several orders (known as mineral orders) placing certain ores and concentrates under allocation control. Up to June 30, 1951, such allocation control orders had been promulgated for manganese ores, zinc ores under toll agreement, tungsten ore and concentrates, and molybdenum concentrates.

The Defense Minerals Administration was authorized to provide financial assistance for exploration projects to stimulate search for new sources of critical and strategic metals and minerals. On a modified matching basis, the Government would contribute 50, 75, or 90 percent of the cost, of each eligible exploration project, the percentage depending on the mineral sought. Toward exploration costs for chromium, copper, fluorspar, graphite (crucible flake), iron ore, lead, sulfur, molybdenum, and zinc (cadmium) the Government would contribute 50 percent; toward exploration costs for antimony, manganese, mercury, and tungsten, 75 percent; and 90 percent for explorations for beryl, asbestos (spinning grade), columbium-tantalum, corundum, cryolite, industrial diamonds, kyanite (strategic), mica (strategic), monazite and rare earth ores, nickel, platinum group metals, quartz (piezo-electric), talc (steatite), and tin.

Repayment provisions are contained in each exploration contract, and such repayment depends on whether the Government decides within 6 months after completion of the project if a discovery or delineation has resulted that may produce commercial ore. The repayment—without interest—has a limit of 10 years from the date of the contract and is based on a percentage royalty on the net smelter returns or other net proceeds realized from the ore, concentrates, or metal produced. As of June 30, the Defense Minerals Administration had received 696 applications for exploration project loans even though the program was not started until April 6. Of that number, 36 received final approval, involving an aggregate in Government contributions of $1,676,040. The Defense Production Administrator had set aside $10,000,000 for such projects, and with the accelerated rate of processing these applications noted at the end of the fiscal year, it was believed that as many or more exploration contracts would be executed in July or August.

Another method employed by the Defense Minerals Administration to stimulate the mineral industries generally was passing on applications for procurement contracts in which floor prices would be guaranteed over a given period of years as an assurance against market risks and to make efficient continuing mining and milling operations feasible. The contracts are in the form of purchase commitments if the commodity's price falls to a certain floor price level, purchase and resale contracts, and commitments to subsidize if the market price falls. After individual studies of each application, the Defense Minerals Administration transmitted the case to the Defense Production Administration with a recommendation that it certify borrowing authority for such contract, or reject it, whatever the case. In cases favorably acted upon, the Defense Production Administration directed the General Services Administration to negotiate terms of price guaranty, subsidy, or grant contract. Administerial duties also were vested in the General Services Administration so that the Defense Minerals Administration actually performed only the initial investigative work. There were several indications that this phase of the Defense Minerals Administration's activities would be transferred in the near future to some other Government agency.

As of June 30, 1951, the Defense Minerals Administration had received applications for 85 purchase contracts. Fourteen were approved after thorough investigation as technically feasible. Inasmuch as the actual negotiating of the contracts and the terms of same were handled by General Services Administration, the Defense Minerals Administration had no available data on dollar values or tonnages involved at the close of the fiscal year on June 30, 1951.

Production loans for fixed investments in order to enlarge facilities for increased production—another method of Government assistance—are handled ultimately by the Reconstruction Finance Corporation, and the role of the Defense Minerals Administration was essentially the same as for the purchase contracts. DMA examined the technical and economic aspects of each proposal and then submitted a report of its findings plus recommendations to the Defense Production Administration. If the Defense Production Administration certified the essentiality of the project, it was recommended for approval to the Reconstruction Finance Corporation. Although at the end of the fiscal year 669 applications for production loans had been received by the Defense Minerals Administration, most of these were converted to applications for exploration assistance or purchase contracts, none was approved. One guaranteed loan amounting to $374,400 was certified out of two applications approved before June 30.

Another phase of the defense production program where the Defense Minerals Administration played an important role was in the reviewing of applications for accelerated tax amortization for new facilities in the minerals industries, including mines, mills, smelters, refineries, etc. Authorized in the Internal Revenue Act of 1950, the rapid tax write-off was designed to encourage an expansion in the production of essential mineral commodities by developing new facilities or expanding existing plants.

Applications for accelerated tax amortizations relating to commodities for which DMA was delegate agency were received by DMA from DPA for consideration. Upon completion of analysis of the applications, a recommendation for either approval or denial was returned to DPA who either accepted or rejected DMA's recommendation. If approved by DPA, a Certificate of Necessity was issued and certification made to the Treasury Department.

These certificates of necessity granted by the Defense Production Administration allowed companies to depreciate for income tax purposes a designated percentage of the cost of the new facility over a 5-year period instead of the 15- to 20-year period in effect before passage of the Internal Revenue Act of 1950. The Defense Minerals Administration had received 402 applications for accelerated tax amortization contracts at the close of fiscal year 1951. Of that number 130 of them—involving an aggregate total of $641,041,390—had been certified as eligible for speedy amortization to the Defense Production Administration. As a result of these new facilities a substantial annual increase in strategic commodities is expected during the 1951–55 period.

Efforts to increase supplies from overseas mineral sources were hampered by growing nationalistic tendencies in the countries involved, lack of machinery and equipment in those overseas areas, native reluctance to dissipate natural resources, certain political considerations, not to mention inadequate transportation facilities. At the end of the fiscal year 1951, little had been accomplished to expand the inflow of foreign raw materials.

Early in the organization of the Defense Minerals Administration, the agency took steps to assure the necessary production materials for the maintenance, repair, and operation of the metal mines and nonferrous smelters, and the nonmetallic mines. This involved obtaining an adequate supply of repair parts and new equipment to continue the mechanization of the properties. Acting as claimant agency for the minerals industries in this field, DMA maintained a staff whose job it was to get the priorities necessary for the maintenance, repair, and operation of the mines and plants. To facilitate matters, a serialization, or numbering, of mines was established, based on applications for Federal assistance. In May 1951, the allocation and priority controls on the manufacture and distribution of mining machinery under the Defense Production Act were returned to the National Production Authority under an interagency agreement. However, DMA continued to function as claimant agency for the mining industry in determining industry requirements for maintenance, repair, and operating supplies.

Because numerous mining operations, especially exploratory projects, are in isolated areas, the Defense Minerals Administration's Housing and Utilities Branch established a well coordinated liaison with the Bureau of Public Doads. As far as access roads are concerned, the arrangement was entirely satisfactory, inasmuch as the Administrator had the authority to certify the essentiality of access roads, and the Bureau of Public Roads was largely governed thereby. The Defense Minerals Administration was permitted to submit requests for funds to be included in the budget of the Bureau of Public Roads to be earmarked for strategic and critical mineral roads, while, at the same time, the Atomic Energy Commission was using DMA access roads certification to process its mineral roads.

The Defense Minerals Administration worked in close cooperation with the Bureau of Mines and the Geological Survey and relied heavily on the staffs of these two old line agencies in carrying out its duties. In Washington a Coordinating Committee comprising the director of the Geological Survey, director of the Bureau of Mines, and administrator of DMA, or their representatives, coordinated the activities of the three agencies. Commodity working groups from the three agencies also were organized and rendered outstanding service in the program. In the field, the Defense Minerals Administration maintained no staff, but relied on Bureau of Mines-Geological Survey field teams established in eight regions. These field teams assisted applicants, reviewed applications in the light of existing data, and determined what additional investigations were necessary to arrive at a decision. They also arranged for field or laboratory studies as needed, appraised the results and reported to Washington, and helped call the coordinating committee's attention to projects that the teams felt worthy of consideration.

In appraising the Defense Minerals Administration's work during these early months, it is surprising how much the new agency actually was able to accomplish in such a brief period, with the tempo of the Korean conflict increasing and the ever-present threat of a world-wide armed struggle. Generally, despite the handicaps overcome shortly after its inception, the Defense Minerals Administration in a scant 6 months of operations successfully initiated several practical programs destined to expedite and increase production of the Nation's strategic and essential metals and minerals, and at the end of the fiscal year was confident that the over-all objective, so necessary to national defense, ultimately would be attained.

The organization had been rounded out by June and all key positions filled by competent people, many of them on loan from private industry. In addition to the Administrator's staff, there were four main divisions, with their respective branches, as follows:

Supply Division, with branches for copper, light metals, minor and rare metals, ferroalloys, lead-zinc, iron ores, and industrial minerals.

Production Expansion Division, with branches for procedures, evaluation, and control.

Requirements Division, with branches for housing and utilities, MRO, mining machinery, manpower, energy, and transportation.

Foreign Division, which handled problems peculiar to foreign mineral procurement and supply.

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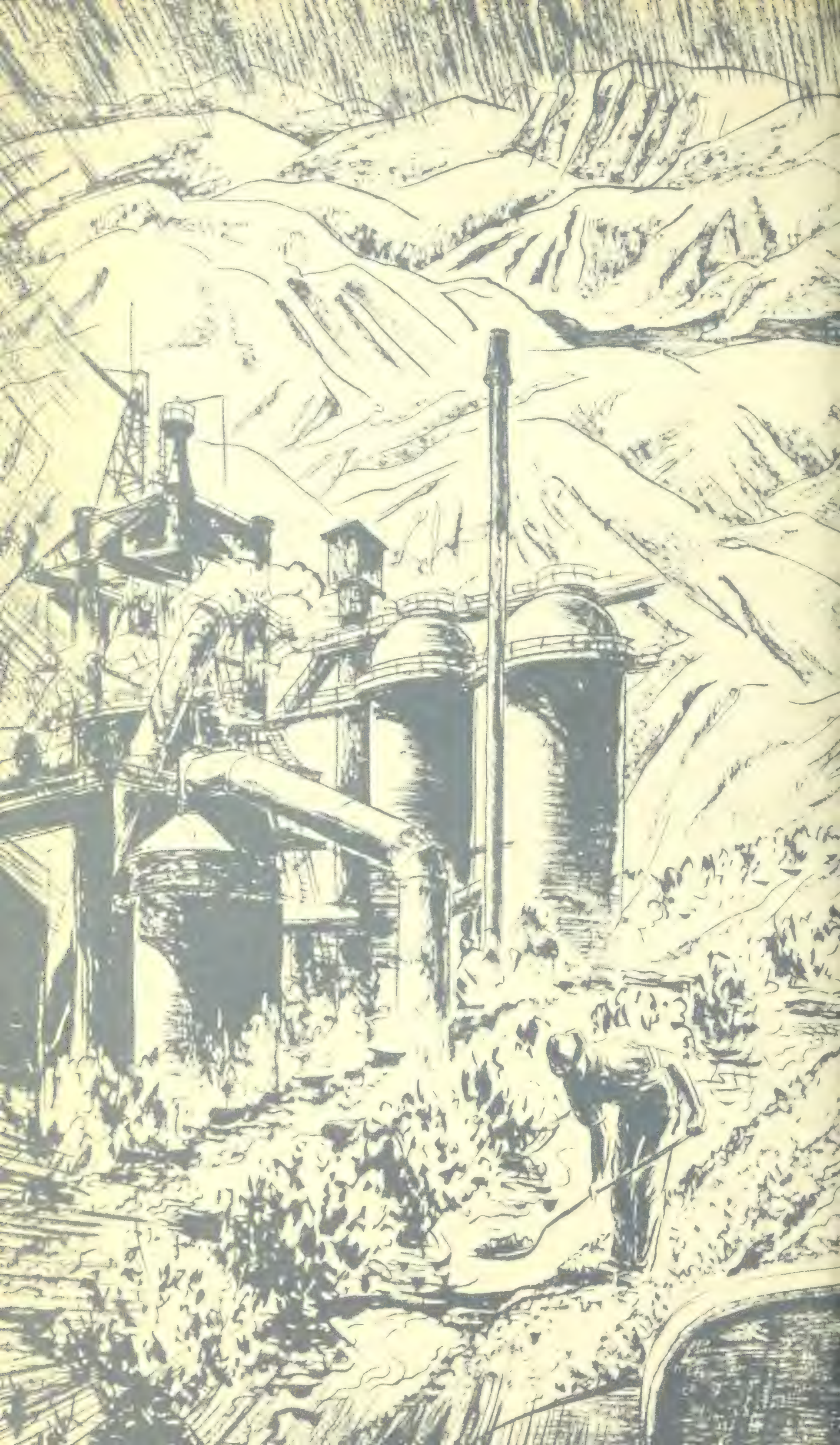

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OSCAR L. CHAPMAN

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FISCAL YEAR ENDED JUNE 30

UNITED STATES DEPARTMENT OF THE INTERIOR

Oscar L. Chapman, Secretary

March 3, 1849

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March 3, 1849

THE SECRETARY OF THE INTERIOR
WASHINGTON

My Dear Mr. President:

I am transmitting herewith the reports of the agencies of the Department of the Interior for the 1952 fiscal year.

These reports constitute the record of accomplishment of a Department which is responsible for the conservation and full development of a great part of the natural wealth of the people of the United States, and which has a very important part to play in the never-ending struggle to make our democracy broader, stronger and more enduring.

These accomplishments cover a number of very broad fields. They range all the way from the Reclamation programs which harness our rivers, create low cost electric power and bring arid land under the plow, to the work by which our territories and island possessions are brought closer to full membership in the great community of self-governing Americans. They include the research and experimental work which will enable industry to make better use of some of our great natural assets, and they also include the steps taken to protect our heritage of range land and timber, of metals and fuels, of fish and of wildlife. They tell of the progress made in providing recreational facilities and cultural values for all the people through our National Park system. They also describe the painstaking work that is being done to bring our Indian population up from poverty and despair to self-reliant citizenship.

These reports tell a great story, and they speak for themselves. I believe every American can take pride in this record and can draw from it a new admiration for the vigorous democracy which continues to carry on with these unfinished tasks.

Sincerely yours,

Oscar L Chapman

Secretary of the Interior.

The President
The White House
Washington, D. C.

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BUREAU OF RECLAMATION

Michael W. Straus, Commissioner

DESIGN AND CONSTRUCTION

On June 17, 1952, the Bureau of Reclamation celebrated its Golden Jubilee—50 years of engineering accomplishment in the conservation, development, and utilization of the precious water and land resources of the West. A notable contribution to this half-century of progress was made in the fiscal year 1952 construction record.

An investment of about 212 million dollars was translated into useful works on Reclamation projects during the year. Although material shortages, staffing restrictions, and other limiting factors imposed difficulties in the design and construction workload, more than 640 construction, material, equipment, and supply contracts were awarded for the fiscal year period. The contracts represented an aggregate of more than 123 million dollars. Contracts for construction comprised 112 million dollars of this amount, or about 91 percent. For the year the Bureau had a 271-million-dollar construction program under way. Construction contracts in force at the end of the year totaled about 274 million dollars.

Reclamation construction during the year not only gave impetus to formal inauguration of water service to hundreds of thousands of acres of irrigable land, but it also made notable additions to the country's power supply. A block of 241,700 kilowatts of hydroelectric energy was added to the Bureau's generating capacity. Extension of the power system embracing hundreds of miles of new electrical transmission lines proceeded at an increasingly high rate.

The year was highlighted by the placing in service of three outstanding irrigation pumping plants, each the heart of a project greater than any in the Bureau's history—Columbia Basin in Washington, Central Valley in California, and Colorado-Big Thompson in Colorado. The Bureau also initiated major construction on the Eklutna project in Alaska, its first undertaking outside the traditional 17-western-State sphere of Reclamation activities. Palisades Dam in Idaho-Wyoming, the largest earth-fill dam to be undertaken in Reclamation history, was placed under construction late in the year. On the Columbia Basin project, first major delivery of water to project lands was begun, and completion of installation of remaining generating units at Grand Coulee power plant brought this world's largest hydroelectric power plant to its full name-plate capacity. Hungry Horse Dam construction continued its rapid pace, and the goal of one million acre-feet of storage was reached by the end of the fiscal year. Missouri River Basin project progress was notably identified with completion of Cedar Bluff, Shadehill, and Boysen Dams and Angostura power plant.

The Bureau's participation in the great expansion of foreign assistance activities extended Reclamation's influence to world-wide scope. As part of this cooperation, engineer specialists were sent to numerous countries of both hemispheres to investigate development possibilities and to advise on projects.

The Design and Construction Division's administrative management practices received continued scrutiny, and its productive efforts in the direction of improved management was given departmental recognition.

Contract Awards

Major contracts awarded during the year are summarized in table 1. Among the features placed under contract for construction were Palisades Dam and power plant on the Palisades project in Idaho-Wyoming, and Eklutna tunnel on the Eklutna project in Alaska, Nimbus Dam and power plant and Folsom power plant on the Central Valley project in California, Alcova power plant on the Kendrick project in Wyoming, Jamestown Dam on the Missouri River Basin project in North Dakota, and 10 miles of the St. Vrain supply canal on the Colorado-Big Thompson project in Colorado.

TABLE 1.—Major Bureau of Reclamation contracts awarded in fiscal year 1952

Feature	Project	Amount of award
Palisades Dam and power plant and relocation of roads	Palisades	$29, 180, 346
Eklutna tunnel	Eklutna	17, 348, 865
Nimbus Dam and power plant	Central Valley	6, 067, 354
Folsom power plant	do	5, 772, 960
Completion of Davis Dam spillway stilling basin and excavation for Colorado River channel improvement.	Davis Dam	2, 731, 882
Alcova power plant	Kendrick	2, 324, 224
10 miles St. Vrain supply canal	Colorado-Big Thompson	2, 268, 292
Jamestown Dam	Missouri River Basin	1, 868, 862
50 miles pipelines for Pt. 2 of unit 9, Coachella Valley distribution system, All-American canal system.	Boulder Canyon	1, 598, 798
59 miles laterals, and pipelines for Area P–1, Potholes East canal.	Columbia Basin	1, 598, 362
15 miles concrete pipelines for Carpinteria section of South Coast conduit.	Cachuma	1, 471, 950
13 miles of Courtland canal	Missouri River Basin	1, 420, 238
90 miles laterals for Area W–5, West canal	Columbia Basin	1, 297, 351
Excavation for power and outlet tunnels, Palisades Dam	Palisades	1, 242, 700

Principal Features Completed

Principal features completed on Bureau projects are shown in table 2. These include 4 dams, 2 power plants, 4 pumping plants, 211 miles of main canals and wasteways, and 856.14 miles of transmission lines.

TABLE 2.—Principal features completed on Bureau of Reclamation projects in fiscal year 1952

Feature	Project	State
Grand Coulee power plant—Generators R-7, R-8, and R-9.	Columbia Basin	Washington.
70 miles main canals and wasteways	do	Do.
Tracy pumping plant	Central Valley	California.
18 miles Delta-Mendota canal	do	Do.
19 miles wasteways for Delta-Mendota canal	do	Do.
165 miles transmission lines	do	Do.
12 miles South Coast conduit (Goleta Section)	Cachuma	Do.
Boulder power plant—Generators A-4 and A-9.	Boulder Canyon	Arizona-Nevada.
Gila pumping plants Nos. 1, 2, and 3	Gila	Arizona.
62 miles main canals (Mohawk and Wellton)	do	Do.
Part 1 of unit 9, Coachella Valley distribution system.	All-American canal system	California-Arizona.
Platoro Dam	San Luis Valley	Colorado.
133 miles transmission lines	Rio Grande	New Mexico.
10 miles main canal	Riverton	Wyoming.
Shadehill Dam	Missouri River Basin	South Dakota.
Angostura power plant	do	Do.
Boysen Dam and power plant building	do	Wyoming.
300 miles transmission lines, Transmission Division.	Missouri River Basin	North Dakota, Wyoming, Colorado, Nebraska.
Cedar Bluff Dam	do	Kansas.
18 miles Superior canal	do	Nebraska-Kansas.
14 miles Courtland canal	do	Do.
9 miles of tunnels (Rattlesnake, Carter Lake, Olympus, and Pole Hill).	Colorado-Big Thompson	Colorado.
180 miles transmission lines	do	Do.
28 miles transmission lines	Kendrick	Wyoming.

Progress of Construction

The 1952 fiscal year was outstanding because of the advancement of construction on several multiple-purpose undertakings to the status of project-wide completion of major structures and initiation of integrated development for irrigation, power production, and other functions.

On the Central Valley project, the Tracy pumping plant, Delta-Mendota canal, and Delta-Cross channel were completed, and first integrated operation of the project was begun, climaxing many years of intensive construction activity. Four of the six giant pumps of the Grand Coulee pumping plant on the Columbia Basin project were installed and pumping of water for eventual delivery to 66,000 acres of irrigable land was started during the 1952 irrigation season. The last three generating units were installed in the Grand Coulee power plant, bringing the plant's nameplate capacity to its total 1,974,000 kilowatts.

Completion of the Missouri River Basin project's Cedar Bluff, Shadehill and Boysen Dams, and Angostura power plant, virtual completion of Boysen power plant, and 300 miles of transmission lines for far-flung areas were significant advances on the huge basin-wide development.

With the installation of Generators A–4 and A–9 in the Hoover power plant on the Boulder Canyon project, the plant's capacity was brought to 1,167,300 kilowatts, second largest hydroelectric power installation on Reclamation projects.

Elsewhere on Reclamation projects, Platoro Dam on the San Luis Valley project was completed this year. Several parts of the Gila project, including sections of the Mohawk and Wellton canals and the Wellton-Mohawk pumping plants were completed, thus bringing new areas into productive operation in time for the 1952 irrigation season.

Cachuma Dam on the Cachuma project in California was brought to within 30 feet of the crest elevation during the year and the outlet works was completed. Good progress was maintained on the Colorado-Big Thompson project: Four important tunnels—Rattlesnake, Carter Lake, Olympus, and Pole Hill tunnels—were completed.

Construction of Hungry Horse Dam and power plant continued to set a fast pace throughout the year. The record for concrete placement was established in July, comprising a daily average of 7,600 cubic yards, and a total placement of 235,650 cubic yards for the month. At the end of the year a total of 2,706,000 cubic yards had been placed in the dam; only 250,000 cubic yards remained to be placed for the remaining 50 feet of the 564-foot-high structure. Construction of the power plant proceeded rapidly, and installation of the first unit was started in March.

Although somewhat behind schedule, construction progress on Canyon Ferry Dam and power plant was generally satisfactory during the year. By June 30 more than 268,000 cubic yards of concrete had been placed in the dam, or about 71 percent of its total volume.

On other projects, construction advanced on features under contract, indicating that such important works as Carter Lake, Rattlesnake, Willow Creek Dams and Pole Hill power plant on the Colorado-Big Thompson project, Trauger pumping plant on the Central Valley project, Cachuma Dam on the Cachuma project, Big Sandy Dam on the Eden project, and Keyhole Dam and Boysen power plant on the Missouri River Basin project, would be completed in fiscal year 1953.

Despite the severity of Alaskan climatic conditions, intensified by rugged mountainous topography, and other difficulties, construction advanced rapidly during the year on the Bureau's Eklutna project, a transmountain diversion development which is to provide defense and industrial electric power for the Anchorage and Palmer areas.

Since October 1951 when major construction activities began on the project, the gate shaft for the intake of the Eklutna tunnel was sunk to its full depth, excavation proceeded steadily in the tunnel and lower penstock portal, and work was continued on the adit portal high on the mountain near the downstream end of the tunnel.

Construction of the 4½-mile-long, 9-foot-inside-diameter pressure tunnel and companion facilities was carried out during the year under a contract awarded September 1951. It is the first major contract ever awarded by the Bureau for construction on a Reclamation undertaking outside the mainland of the United States. Other work on the project included construction of the 25-mile-long Eklutna-Anchorage transmission line and alterations of the existing Eklutna Dam.

Development of the Eklutna project marks the initial step in a comprehensive program for conservation and multiple-purpose use of the water resources of Alaska to meet the needs of economic advancement and national defense as authorized by the Congress in 1949. The project is to make available an estimated annual output of 143 million kilowatt-hours of firm and 16 million kilowatt-hours of secondary electrical energy to meet the critical shortage of power in the Anchorage and Palmer areas, as well as to provide other water resource conservation benefits.

Continuing Program

Major features on Bureau of Reclamation projects expected to be completed in fiscal year 1953 (as shown in table 3) include 4 dams, 2 power plants, 8 pumping plants, 133 miles of main canals, 327 miles of transmission lines, and pipe lines and laterals to serve 166,000 acres of land.

TABLE 3.—Major features on Bureau of Reclamation projects expected to be completed in fiscal year 1953

Feature	Project	State
Carter Lake Dam	Colorado-Big Thompson	Colorado.
Rattlesnake Dam	do	Do.
Willow Creek Dam	do	Do.
Pole Hill power plant	do	Do.
Willow Creek pumping plant	do	Do.
14 miles Horsetooth feeder canal	do	Do.
12.7 miles North Poudre supply canal	do	Do.
3.7 miles Willow Creek canal	do	Do.
1.3 Bald Mountain tunnel	do	Do.
67 miles canals	Columbia Basin	Washington.
Laterals to serve 89,000 acres	do	Do.
Ringold pumping plant	do	Do.
Babcock pumping plant	do	Do.
Lower and Upper Saddle Gap pumping plants	do	Do.
Lower and Upper Relift Scooteney pumping plants.	do	Do.
Trauger pumping plant	Central Valley	California.
200 miles of pipeline laterals to serve 77,000 acres	do	Do.
Keyhole Dam	Missouri River Basin	Wyoming.
Boysen power plant	do	Do.
31 miles canals	do	South Dakota.
327 miles transmission lines	do	Do.
4.9 miles Franklin South Side pump canal	do	Nebraska.
Franklin South Side pumping plant	do	Do.
Cachuma Dam	Cachuma	California.

TABLE 3.—Major features on Bureau of Reclamation projects expected to be completed in fiscal year 1953—Continued.

Feature	Project	State
Glen Anne and Lauro regulating reservoirs	Cachuma	California.
1 mile Sheffield tunnel	do	Do.
Big Sandy Dam	Eden	Wyoming.
6 miles Means canal	do	Do.
6 miles Duchesne tunnel	Provo River	Utah.
31 miles Provo reservoir canal	do	Do.
Relocation 15.6 miles of State highway	Boise	Idaho.
Eklutna Dam	Eklutna	Alaska.
32 miles Eklutna-Anchorage transmission line	do	Do.
Part 2 of unit 9, Coachella Valley distribution system.	All-American canal system	California.
42 miles Colorado River levee construction	Colorado River front work and levee system.	Nevada-California-Arizona.
21 miles channelization of the Rio Grande		New Mexico.

Among the principal structures expected to be placed under construction on Reclamation projects (table 4) during the next fiscal year are 10 dams and 13 detention dams, 1 power plant, 2 pumping plants, 295 miles of transmission lines for a three-State area, 200 miles of main canals, and laterals to serve more than 250,000 acres of land.

TABLE 4.—Major features expected to be placed under construction on Bureau of Reclamation projects in fiscal year 1953

Missouri River Basin project:
  Tiber Dam, Montana.
  Pactola Dam, South Dakota.
  Webster Dam, Kansas.
  Kirwin Dam, Kansas.
  Missouri diversion dam, Montana.
  Bartley diversion dam, Nebraska.
  9 Courtland Canal detention dams, Kansas.
  Little Porcupine power plant, Montana.
  Crow Creek pumping plant, Montana.
  295 miles transmission lines, Wyoming, South Dakota, North Dakota.
  54 miles Franklin Canal, Nebraska.
  20 miles Bartley Canal, Nebraska.
  19 miles Upper Meeker Canal, Nebraska.
  8 miles Naponee Canal, Nebraska.
  6 miles Toston Canal, Montana.
  4 miles Lombard Canal, Montana.
  16 miles Bartley laterals, Nebraska.
  Laterals to serve 14,000 acres, Nebraska.
  Laterals to serve 6,000 acres, North Dakota.
  8 miles drainage system, Montana.
Columbia Basin project, Washington:
  40 miles of canals.
  Warden pumping plant.
  Laterals to serve 82,000 acres.
Central Valley project, California:
  Sly Park Dam.
  Camp Creek diversion dam and Camp Creek tunnel.
  Laterals to serve 114,000 acres.
Cachuma project, California:
  Ortega regulating reservoir.
  Carpinteria regulating reservoir.
  Laterals to serve 17,000 acres.
Eden project, Wyoming:
  Prospect diversion dam.
  20 miles Eden Canal enlargement.
  30 miles Eden laterals.
Solano project, California:
  Monticello Dam.
San Diego project, California:
  61 miles second barrel, San Diego Aqueduct.
Vermejo project, New Mexico:
  Detention dams Nos. 2, 7, 8, 13.
Colorado-Big Thompson project, Colorado:
  16.5 miles Boulder Creek supply canal.
Weber Basin project, Utah:
  12 miles Gateway canal.
Provo River project, Utah:
  35 miles Provo River channel revision.
Gila project, Arizona:
  Laterals to serve 14,500 acres.
Grants Pass project, Oregon:
  Rehabilitation of Savage Rapids Dam.
All-American Canal System, California:
  Laterals to serve 4,600 acres.
Colorado River Front Work and Levee System project, California, Nevada, Arizona:
  29 miles of levee and floodway channel construction.

Design Activities and Developments

The pressure of field demands for construction details was augmented by requests for preliminary designs and estimates for project plans, various special investigations, and rehabilitation designs. Following Congressional appropriation for dams on the Palisades, Missouri River Basin, and the Vermejo projects, intensive studies and designs were undertaken for earliest possible initiation of construction.

By increased efficiency of operations, improved coordination with field forces, and by selection of new types of construction materials and adoption of new techniques, the design workload was facilitated and close adherence to the expedited program schedules was made possible. Major economy in certain designs was a concomitant achievement.

Numerous design developments characterized the Division's work for the year. Outdoor and semi-outdoor plant construction was investigated for several power and pumping plants. For the Ringold pumping plant on the Columbia Basin project in Washington, an outdoor type of plant, individual removable steel housings were selected for protection of the indoor-type of motors, a design advancement which will be reflected in economy of construction.

Rising labor costs made it necessary to change from reinforced concrete to other types of plant buildings. Designs for the Palisades power plant in Idaho incorporated steel frame and brick curtain walls; for the Little Porcupine power plant in Montana, a steel frame and composite siding were selected. These design changes will result in major economies in construction and will expedite building schedules.

Other design effort contributed to construction economy and conservation of critical materials. Stainless steel and monel metal were conserved by adoption of rubber water stops for articulated concrete structures. To conserve steel, structural designs called for "high bond" steel reinforcement bars in concrete buildings; the surface ribs on the bars reduce the length of anchorage embedment and permit shorter splices—significant improvements which will result in large reduction of steel requirements for Reclamation work. Important economies were also effected in the development and adoption of a caisson type of footing for electrical transmission towers in place of the more costly pile type of footing.

Continued progress was made in the Bureau's lower cost canal lining program. The practicability of applying underwater asphaltic seals to canals while they are in operation was under intensive study during the year. A critical inspection made of various canal linings on Northern projects indicated the importance of maintaining certain standards of constructon and maintenance if the lining installations are to remain serviceable. Review of performance of heavy compacted earth linings led to the conclusion that it is a promising type of lining to reduce seepage, provided proper materials are incorporated in its construction.

To simplify operations and to strengthen design, location, and construction procedures, a thorough review of plans for the canals and distribution system on the Columbia Basin project was undertaken by the Division. Improved procedures adopted involved relaxation, under certain conditions, of the conservative standards of canal location, simplification of surveying and mapping methods, and reduction of other refinements.

An interesting design innovation was the development of a heating system in the Alcova power plant building in Wyoming which will utilize the hot water from adjacent springs. Also at Alcova, the use of lightweight, precast concrete roof slabs and laminated, prefabricated metal and fiberglass wall panels resulted in savings in material costs and expedited the building's construction.

Designers' operating instructions, which are prepared and issued to assure proper and efficient operation of installed equipment and machinery in Bureau projects, continued useful since their inception 2 years ago. During the past year 30 such criteria were issued embracing those for operation of canal systems, storage and diversion dams, power and pumping plants, substations, and electrical transmission and radio communication systems.

Looking ahead to western electrical transmission needs for the next 2 decades or more, the staff undertook the investigation of technical problems involved in development of a super-grid to transmit electrical energy throughout the 17 western States; voltages proposed would be higher than any yet used in the United States. Engineering and economic studies indicated that it may be practicable to establish generating plants in the coal fields of the Rocky Mountain States and transmit more than 20 million kilowatts of electric power to load centers up to 600 miles away; cost of such transmission may be competitive with methods of transporting coal to load-area steam plants.

Specification Requirements

In general, the national rearmament program and material shortages did not have an adverse effect on bidding interest and competition for Bureau construction work. However, the strongest interest and greatest competition were apparent in work involving heavy construction and earthwork which required a minimum of critical materials. Sufficient bids were received for most of the specifications advertised, and the majority of bids were within acceptable limits of the engineers' estimates. Foreign manufacturers showed increasing interest in Bureau work and submitted bids on Reclamation equipment, especially electrical machinery.

To alleviate bidder's concern regarding availability of materials under the controlled materials plan, a specifications procedure was initiated to list controlled material allotments that have been requested or that have been approved and reserved for a particular job. All specifications provided that for work delayed by operations of the controlled materials plan the time for performance would be extended to compensate for such delays.

During the year the standard specifications for construction of canal systems were revised and a second edition was issued. The new edition was improved by incorporation of practical suggestions submitted by construction engineers, contractors, and material suppliers.

To expedite processing of contracts for minor construction work, an informal contract form was initiated for advertising and award purposes. The new specifications were written to cover only the direct requirements of the particular work, thus encouraging small local contractors to bid on Reclamation work. Specifications for precast concrete pipe systems were also revised to eliminate the majority of detail requirements and to provide for acceptance of guaranteed work on a performance basis.

Administrative Developments

Paralleling the reduction in appropriations, several organizational changes were effected during the year resulting in simplification of the over-all organization of the Division, better utilization of available personnel, and reduction in costs of supervision. Among these changes, the major operating segments of the organization were reduced in number, a staff office level was established, and several units were shifted from one section to another to achieve a more consistent grouping of functions.

Continued attention was directed throughout the year toward developing greater flexibility and versatility of the staff. Improvement in staff performance was noted as a result of the rotation plan initiated several years ago permitting junior engineers to work in various offices throughout the organization. Areas of interchangeability as reflected in competitive levels established for professional and subprofessional personnel were under administrative review. As a result of the broadening effect on staff development activities and change in administrative viewpoint brought about by experience, establishment of broader levels of competition was assured.

Another development directed toward lowering of administrative costs was the initiation of procedures to simplify preparation of technical field reports. Several reports were eliminated, others were consolidated, and the frequency of reporting was changed to minimize the month-end-report burden of field offices.

In furtherance of their administrative potential manifested during their rotation assignments in the Division, two young engineers participated in the third management training program of the Department of the Interior. Assignments to administrative work in various bureaus and offices were supplemented by formal university training.

The reciprocal detail of field engineers to the Denver offices for training in specialized fields during the winter season was conducted with marked success. Engineers from the field were trained in contract administration, specifications writing, grouting, and other special types of work. The value of the training course conducted by the engineering laboratories in concrete control and betterment of concreting operations was exemplified by better and more uniform concrete throughout Bureau projects.

To keep the staff abreast of changes in the national economy and the impact of the current defense effort on resources development, a representative group of supervisory engineers from the Design and Construction Division participated in a 2-week economic mobilization course held in Denver under the direction of the civilian committee of the Industrial College of the Armed Forces. Principles and problems of mobilization and methods and procedures for making the best use of our natural resources in any emergency were discussed.

In keeping its staff informed of current problems in the operation and maintenance of Bureau project structures, the Division, through its liaison representative, conferred with officials on 19 projects and in 15 field offices during the year. Information thus obtained was made available to the designing engineers through the media of written and verbal reports, photographs, and moving pictures. The procedures of transferring completed works from construction to operation and maintenance status were coordinated by the Division, 30 such transfers having been effected for the year.

A major activity of the 1952 fiscal year was the collection and organization of data on safety features and practices in use on the Bureau's operating irrigation systems. These data, together with information assembled by the Division, were compiled during the year in a report on safety in the operation of canals and other waterway structures. This report will be made available during the next fiscal year to all Bureau offices and to others to acquaint design and construction engineers, operation and maintenance personnel, and officials of water-user-operated projects of the latest advances in safety practices for such structures.

Drainage Activities

To maintain the productivity of Reclamation projects and to safeguard the investment in such undertakings as well as the holdings of the water users, increased emphasis was given during the year to the protection of agricultural lands from seepage and high ground water and also to their protection from flood runoff. The appointment of regional, district, and project drainage engineers, and the Division's participation in formulating the basic policies on drainage in relation to land classification, were indicative of the year's emphasis placed on drainage in Bureau developments.

Extensive consultations were held by the Division's specialists in drainage and ground water in connection with drainage problems and land classification as related to drainability of projects soils. On the Oahe unit of the Missouri River Basin project in South Dakota, particularly, the problem of drainability of glacial till soils is without precedent, and comprehensive investigations and analyses were initiated to determine the drainability of the unit.

Research Activities

During the year the Denver Engineering Laboratories assisted design engineers and field forces in the solution of a widely diversified assemblage of complex problems associated with development of Reclamation structures and their operation and maintenance. In addition to this technical assistance, many worthwhile contributions were made toward improvement of field testing equipment and techniques.

Notable progress was made in soil test work. Studies in the visual soil classification system advanced and a more definitive approach to methods of describing physical and structural properties of soil-rock mixtures was developed. Much work was done in testing and identification and classification of expansive clays which caused heaving and dislocation of structures.

With the assistance of specialists in radioisotope techniques, an apparatus was designed and built and work was initiated on a test procedure for determining soil moisture and density in place by the scattering of neutrons and by gamma radiation. This technique appeared to offer sizeable savings in time and cost of testing as compared with conventional methods. Further research was conducted on electrical methods of reclamation and stabilization of soils.

As a result of a comprehensive research program on a special field test section at Bonny Reservoir in Colorado, soil cement and asphaltic concrete were found to offer possibilities as economical substitutes for rock materials (riprap) on earth dams. These substitute materials may have great usefulness in construction of many earth dams, particularly in the Great Plains States where rock materials are unobtainable locally and must be shipped from distant sources.

Study of loess soils was prosecuted intensively. Considerable data were compiled on load-carrying capacity of loessial soils as a result of the concerted soil driving and testing program, completed this year. Proper procedures for driving piles in loessial soils were also developed as part of the program.

Hydraulic laboratory studies continued under the demands of design and construction problems. Tests conducted on a full-scale weir box turnout pointed favorably toward the development of a low-cost water measuring device for open-ditch types of irrigation systems. Model studies led to the design of an afterbay stilling basin which satisfactorily withstood the turbulent high velocity flows discharged from by-pass energy absorbers. This design has already been applied to several power plants. Progress was also made in the development of simplified stilling basins for small culverts.

Through hydraulic model studies, modification of preliminary designs resulted in improved flow conditions and in reductions in construction costs. A special result of such studies was determination that the maximum discharge through the proposed Yellowtail spillway tunnel will require only a 41-foot-diameter tunnel in place of the contemplated 45-foot-diameter tunnel; major savings in construction may be ascribed to this laboratory work. Model studies of the Nimbus Dam led to reduction of the spillway apron, thereby substantially decreasing concrete requirements.

In other fields of hydraulic laboratory research, much progress was made in resolution of sedimentation problems, particularly in the Missouri River Basin.

Hydraulic research advanced the salt-velocity method of measuring discharge of water through large conduits, and the method is now used in many pump-performance tests. The salt-velocity method offers considerable savings in time and expense, and during the year it was used for discharge measurements in pump-performance tests for the large Granby and Tracy pumping plants.

Studies of structural behavior of mass and reinforced concrete were fully maintained during the year. A comprehensive program for rock-core tests was conducted to supply designers with more complete information on foundation rock conditions. To further knowledge of reinforced concrete design theory for Reclamation construction, a large reinforced concrete beam, 25 feet long and weighing 6 tons, was cast and subjected to exhaustive tests. Completed tests of 10-year-old concrete cores taken from the Shasta Dam test block showed that the concrete has had a consistent gain in strength, which confirms confidence in the permanent strength of the Bureau's concrete structures.

Laboratory efforts emphasized control of concrete quality and economy in current construction and the selection of cements, aggregates, and pozzolans for new structures. The quality of concrete aggregates from numerous projects was determined by suitable tests. Development of a chemical test to determine reactivity of aggregates by the use of sodium hydroxide was part of the year's work. In connection with winter concreting operations, studies were made on heat of hydration of cement and on the use of calcium chloride to protect new concrete placement during cold weather. Because of laboratory investigations, requirements for curing and finishing of concrete in power and pumping plants and for protection of concrete in cold weather were simplified and liberalized. Considerable research was also done in the development and testing of methods of repairing cracks in concrete.

Testing, analyzing, and examining bituminous construction materials controlled the acceptance of approximately 11,000 tons of asphalt for Bureau construction, principally for canal linings. To afford better control of heating of asphalt, specifications were revised to require use of automatic thermometers which will record the temperature during the entire asphalt heating operation.

Laboratory assistance was rendered in establishing improved methods of testing the efficacy of herbicides for cattails, salt cedars, and other noxious growths along canals, and in furthering the development of lower cost canal linings.

Testing and development of protective systems against corrosion of metallic members in numerous Bureau structures were also important activities during the year. Acceptance tests were conducted on 600 samples (representing 276,000 gallons) of paint, oils, and related materials.

Work Performed for Other Agencies

This year was notable for the Division's numerous contributions of its technical resources and skills to the problems of other public agencies and of private agencies and foreign governments. For the International Boundary and Water Commission, the staff prepared designs and specifications for completion of Falcon Dam and power plant, major undertakings of the Commission on the Rio Grande in Texas. Work continued also on construction drawings and specifications for equipment for the dam and power plant. In addition, the staff assisted the Mexican section of the Commission by installing instruments in the power penstock on the Mexican side of the Rio Grande which will record earth pressures of the dam on the conduit.

Under an agreement with the Navy Department, work was begun on the preparation of designs and specifications for 61 miles of the 72-

mile-long second barrel of the San Diego aqueduct. Bureau engineers will also supervise construction of the pipeline which will extend from the Los Angeles Metropolitan aqueduct to San Diego. (The Bureau designed the first barrel of the San Diego aqueduct which was constructed between 1943 and 1945.) For the city of Seattle studies of structural behavior of Ross Dam continued.

The Engineering laboratories also extended considerable technical assistance to numerous governmental agencies and private organizations. On three occasions aid was given to state and local law enforcement agencies in the identification of certain forensic evidence by X-ray diffraction methods. Assistance to the Atomic Energy Commission was given through acceptance tests of concrete aggregates, alkali-aggregate reactivity tests, and strength and elastic property tests of concrete cores for various installations of the Commission. For the Bureau of Mines, the laboratories investigated the possibility of using spent oil shale in concrete mixes. Tests of pozzolans were conducted for the Geological Survey, and aggregate tests were made for the Bureau of Indian Affairs.

Acceptance testing of paints, varnishes, oils, soaps, and waxes were carried out for the Federal Supply Service of the General Service Administration, a continuing activity of the laboratories. Similar acceptance tests of paints and related materials were made for the Forest Service.

The Department of the Army was advised on the analysis of water samples at the Rocky Mountain arsenal; and the Corps of Engineers was given data on tests of asphaltic and concrete construction materials.

Concrete aggregate tests were made for the Tennessee Valley Authority, the Water Resources Authority of Puerto Rico, the Georgia State highway department, and the Kansas State highway commission. The Colorado State highway department was given laboratory assistance in the study of foundation clays, and aggregate investigations and concrete mix studies were completed for the Denver Water Board.

Testing of concrete cores was undertaken by the laboratories for the Metropolitan Water District of Southern California, and for the city of Seattle in connection with its Diablo and Ross Dams. Hydraulic model studies and tests of aggegates and pozzolans for Falcon Dam of the International Boundary and Water Commission were further laboratory activities during the year.

An increased volume of technical studies and laboratory experiments was also accomplished during the year for foreign governments. Technical services for the Snowy Mountains Hydroelectric Authority of Australia included the preparation of designs for the Tumut Pond Dam and for the Adaminaby tunnel and T–1 tunnels. Designs and drawings were also prepared for related control structures and other hydraulic features.

For the Indian Government trial load analyses were carried out in design of a 680-foot-high concrete gravity dam, and stress analyses were initiated for the dam's appurtenant works.

The staff completed its review of the design of the Chao Phya diversion dam, dike, and navigation lock for the Government of Thailand. Stability analyses and preliminary general arrangement layouts were made for the Chao Phya power plant.

The Engineering laboratories contributed to Bureau assistance abroad by conducting hydraulic model studies, concrete mix investigations, and other testing work for the Governments of Australia, India, Japan, Lebanon, and Thailand. The laboratories were also called upon by private engineering firms for technical guidance and research investigations on projects in El Salvador and elsewhere.

International Cooperation

The impressive increase in the Bureau's foreign activities program called on the Division to expand its services to in-service foreign engineers and visitors, supply technical services to foreign countries, provide publications on Reclamation practices and works for their use, and detail engineers to foreign missions. The training program for foreign engineers was improved during the year to assure better education in Bureau practices and procedures, and better coordination with field offices was achieved. In addition, a schedule of weekly lectures covering general engineering practices and design work as carried on within the Bureau was inaugurated during the year for the benefit of foreign trainees. Technical "backstopping" services increased in volume and scope as expanded Reclamation–engineering missions in foreign countries progressed in their work.

Officials from 20 foreign nations participated in the first International Reclamation Conference at Yakima, Washington, held early in June 1952 in conjunction with the Columbia Basin water festival. In Denver, following the conference, the foreign engineers attended a special seminar on irrigation practices conducted by the Division.

Construction Costs

Construction costs showed an over-all rise during the year of about 6½ percent. This was due in large part to increases in labor rates, as equipment costs rose only slightly and materials prices were generally stable. Toward the end of the fiscal year nonferrous materials came into better supply, and in some instances lower prices were experienced on electrical items. Uncertainty prevailed in steel and steel products prices. Because of the strike in the steel industry the supply of steel was short and prices rose accordingly.

Bidding interest in most construction was substantial and active competition resulted in favorable prices. In several instances, little interest was shown to bid on project completion work, and high unit prices were experienced for this type of construction. Unusually high prices were also experienced on several projects located in or near areas where active defense industries were located; these prices may be attributed to inadequate labor supply and resulting high labor costs.

Table 5 lists costs indexes for Bureau of Reclamation construction work based on the combined costs of materials and labor supplied by contractors and material and labor supplied by the Government.

TABLE 5.—Bureau of Reclamation construction cost indexes—fiscal year 1952

Cost indexes based on January 1940 costs=1.00	July 1951	January 1952	June 1952
Dams:			
Earth	2.10	2.10	2.20
Concrete	2.25	2.25	2.25
Pumping plants:			
Building and equipment	2.30	2.40	2.45
Structures and improvements [1]	2.50	2.55	2.65
Equipment	2.10	2.20	2.20
Pumps and prime movers	2.10	2.20	2.20
Accessory electric and miscellaneous equipment	2.20	2.20	2.20
Discharge pipes	2.50	2.55	2.60
Canals and conduits:			
Canals	2.30	2.40	2.50
Conduits (tunnels, free flow, concrete lined)	2.35	2.45	2.60
Laterals and drains	2.50	2.65	2.70
Power plants, hydroelectric:			
Building and equipment	2.20	2.30	2.35
Structures and improvements [1]	2.45	2.55	2.65
Equipment	2.10	2.20	2.20
Turbines and generators	2.10	2.20	2.20
Accessory electrical equipment	2.10	2.20	2.20
Miscellaneous equipment	2.20	2.20	2.20
Penstocks	2.50	2.55	2.60
Transmission switchyards and substations	2.20	2.20	2.25
Transmission lines (wood pole)	2.20	2.25	2.30
Transmission lines (steel tower)	2.15	2.15	2.15
Permanent general property:			
Buildings	2.60	2.60	2.60
Roads and bridges:			
Primary roads	2.25	2.30	2.35
Secondary roads, unsurfaced	2.10	2.25	2.25
Bridges	2.45	2.30	2.50
Composite index	2.25	2.30	2.40

[1] Indexes for structures and improvements on pumping plants and power plants are based on reinforced concrete structures.

Publications

Major technical publications issued during the year were a revised tentative edition of the Earth Manual and a reprint of the fifth edition of the Concrete Manual. The Earth Manual records engineering practices and procedures developed in earth materials, investigations, testing, and construction. The Concrete Manual is an authoritative handbook of information and instruction on concrete control and construction technique.

Also published were three engineering monographs which discuss discharge coefficients for irrigation overflow spillways, photoelastic stress analysis of concrete conduits, and stresses around galleries in concrete dams.

Preparation of technical records of design and construction gained in momentum during the year. These records provide comprehensive information on design and construction of specific Bureau structures. The final design report for Angostura Dam was published, and the report for Heart Butte Dam was completed and is to be issued early in the next fiscal year. Technical records of an additional 32 major structures were in preparation, and about 10 of these records are planned to be duplicated or published during the following year.

Under preparation this past year were: The sixth edition of the Concrete Manual; first editions of the Earth Manual, Paint Manual, Manual for Measurement of Irrigation Water, and the Welding Manual; an additional 15 monographs planned to be issued in the next fiscal year; and a revised edition of Dams and Control Works. Under way also was the compilation of an exhaustive index of all Bureau specifications which have been issued since inception of Reclamation activity in 1902.

To record the methods used and the accomplishments in the Bureau's lower cost canal lining program for a wide range of readership, an illustrated semitechnical bulletin entitled, "Canal Linings and Methods of Reducing Costs" was published. A Golden Jubilee Fact Book describing Reclamation's accomplishments in the past 50 years was also printed for nontechnical readers.

The Advance Construction Bulletin and Advance Equipment Bulletin which report Bureau work proposed for the following 3 months were given increased circulation as requests from contractors and subcontractors were received. The annual forecast edition of The Advance Construction Bulletin which describes work to be undertaken for the remainder of the fiscal year was issued in increased numbers to promote competitive interest among wider numbers of prospective bidders.

Participation of design and construction engineers in professional activities and their contributions to technical literature continued at high level, with more than 100 papers and articles published or presented, including a number before international organizations. A Bureau of Reclamation symposium commemorating the fiftieth anniversary of Reclamation, held in conjunction with the summer convention of the American Society of Civil Engineers at Denver in June, was highlighted by presentation of many technical papers by Bureau engineers and by open house events held on June 17.

TABLE 6.—Bureau of Reclamation storage dams

State and project	Name of dam	River	Type	Capacity	Height	Length	Volume	Year
Arizona:								
Salt River	Bartlett	Verde	Concrete multiple-arch	[2] 179, 500	287	1, 063	182, 000	1939
	Cave Creek [1]	Cave Creek	do	11, 000	109	1, 648	18, 775	1923
	Horse Mesa	Salt	Concrete arch, power plant	[2] 245, 100	300	803	162, 000	1927
	Mormon Flat	do	do	[2] 57, 900	224	505	59, 900	1925
	Roosevelt	do	Masonry arch-gravity, power plant.	[2] 1, 398, 000	280	1, 125	355, 800	1911
	Stewart Mountain	do	Concrete arch, power plant	69, 800	207	1, 260	120, 500	1930
Arizona-California:								
Parker Dam power	Parker [1]	Colorado	do	717, 000	320	856	380, 000	1938
Arizona-Nevada:								
Boulder Canyon	Hoover (Boulder)	do	Concrete arch-gravity, 2 power plants.	31, 142, 000	726	1, 244	4, 400, 000	1936
Davis Dam	Davis	do	Earth, power plant	1, 820, 000	200	1, 600	4, 357, 500	1950
California:								
Cachuma	Cachuma	Santa Ynez	Earth	232, 000	275	2, 975	6, 600, 000	(4)
	Glenn Ann	Offstream	do	500	102	240	121, 000	(4)
	Lauro	do	do	642	110	540	472, 000	(4)
Central Valley	Friant [1]	San Joaquin	Concrete gravity	521, 000	319	3, 488	2, 135, 000	1942
	Keswick [3]	Sacramento	do	23, 800	159	1, 046	197, 000	1945
	Martinez	Offstream	Earth		38	1, 200	183, 450	1947
	Shasta	Sacramento	Concrete curved-gravity, embankment wing, power plant.	4, 493, 000	602	3, 460	6, 541, 000	1945
Orland	East Park	Little Stony Creek	Concrete arch-gravity	51, 000	139	226	15, 745	1910
	Stony Gorge	Stony Creek	Concrete slab-and-buttress	[2] 50, 200	139	868	43, 100	1928
Colorado:								
Colorado-Big Thompson	Carter Lake	Offstream	Earth (2 dikes)	117, 000	200	1, 235	2, 900, 000	(4)
	Dixon Canyon	do	Earth	(5)	240	1, 215	3, 004, 000	1949
	Flatiron	do	do	19, 000	70	1, 730	364, 500	(4)
	Granby	Colorado	do	546, 000	245	885	2, 901, 300	1950
	Green Mountain	Blue	Earth, power plant	154, 600	300	1, 150	4, 406, 000	1943
	Horsetooth	Offstream	Earth	147, 000	150	1, 610	1, 890, 000	1949
	Marys Lake [3]	do	Earth (2 dikes), power plant	700	40	1, 300	60, 500	1950
	Olympus [1]	Big Thompson	Concrete gravity, embankment wing.	2, 850	60	1, 850	300, 000	1949
	Rattlesnake	Offstream	Earth	2, 000	105	1, 080	408, 000	(4)
	Shadow Mountain	Colorado	do	15, 000	44	600	210, 000	1946
	Soldier Canyon	Offstream	do	(5)	220	1, 420	3, 288, 000	1949
	Spring Canyon	do	do	(5)	215	1, 115	2, 213, 000	1948
	Willow Creek	Willow Creek	do	11, 150	135	1, 075	384, 000	(4)
Fruitgrowers	Fruitgrowers	Alfalfa Run	do	4, 600	55	1, 520	135, 500	1938
Mancos	Jackson Gulch	Offstream	do	10, 000	181	1, 895	1, 988, 000	1948
Pine River	Vallecito	Pine	do	129, 700	162	4, 010	3, 738, 000	1941
Uncompahgre	Taylor Park	Taylor	do	106, 200	206	675	1, 115, 100	1937
San Luis Valley	Platoro	Conejos	do	67, 000	155	1, 525	940, 000	1951

Idaho:								
Minidoka	American Falls	Snake	Concrete gravity, embankment wings.	[2] 1,700,000	94	5,227	313,600	1927
	Jackson Lake	do	do	[2] 847,000	70	4,920	491,700	1911
	Minidoka [1]	do	Earth with concrete, power house section, power plant.	[2] 95,200	86	4,475	257,300	1906
	Grassy Lake	Grassy Creek	Earth	15,500	118	1,170	541,600	1939
	Island Park	Snake, Henry's Fork	do	127,600	91	9,448	464,000	1938
Idaho-Oregon:								
Boise	Anderson Ranch	Boise, North Fork	Earth, power plant	498,200	456	1,350	9,653,300	1950
	Arrowrock	Boise	Concrete arch-gravity	[2] 286,600	354	1,150	636,000	1915
	Cascade	Payette, North Fork	Earth	700,000	107	785	395,000	1948
	Deadwood	Deadwood	Concrete arch	164,000	165	749	56,400	1931
	Deer Flat, Upper	Offstream	Earth	190,100	74	4,000	1,245,000	1908
	Deer Flat, Lower	do	do		46	7,200	1,240,000	1908
	Deer Flat, Middle	do	do		16	950	22,500	1908
Idaho-Wyoming:								
Minidoka	Palisades	South Fork, Snake	do	1,417,600	260	2,100	13,571,000	(4)
Kansas:								
Smoky Hill (Missouri River Basin)	Cedar Bluff	Smoky Hill	do	368,100	204	11,000	8,917,000	1951
Solomon (Missouri River Basin)	Kirwin	North Fork, Solomon	do	(6)	(6)	(6)	(6)	(4)
Kansas-Colorado:								
Upper Republic (Missouri River Basin).	Bonny	South Fork, Republican	do	175,000	160	9,265	8,530,000	1951
Montana:								
Bitterroot	Como	Rock Creek	do	34,800	65	2,550	1,106,000	1910
Hungry Horse	Hungry Horse	Flathead, South Fork	Concrete arch-gravity, power plant.	3,500,000	564	2,115	2,900,000	(4)
Huntley	Anita	Offstream	Earth	[2] 400	42	1,050	142,800	1937
Milk River	Fresno	Milk	do	129,100	111	2,070	2,105,000	1939
	Nelson	Offstream	Earth (5 dikes)	85,500	28	9,900	232,600	1915
	Sherburne Lakes	Swiftcurrent Creek	Earth	[2] 66,100	96	1,086	227,600	1921
Sun River	Gibson	Sun, North Fork	Concrete arch	[2] 105,000	196	960	167,500	1929
	Pishkun	Offstream	Earth (8 dikes)	46,400	50	9,180	599,300	1921
	Willow Creek	Willow Creek	Earth, semihydraulic fill	[2] 32,400	93	650	254,186	1911
Helena-Great Falls (Missouri River Basin).	Canyon Ferry	Missouri	Concrete gravity	2,050,000	220	1,010	455,600	(4)
Nebraska:								
Frenchman-Cambridge (Missouri River Basin).	Enders	Frenchman Creek	Earth	74,000	134	2,603	1,951,000	1950
	Box Butte	Niobrara	do	31,300	87	5,508	1,422,000	1946
	Medicine Creek	Medicine Creek	do	93,000	180	5,630	2,883,000	1950
Mirage Flats	Trenton	Republican	do	172,000	95	7,800	(6)	(4)
Nebraska-Wyoming:								
North Platte	Guernsey	North Platte	Earth, power plant	48,100	135	560	586,200	1927
	Lake Alice, Upper	Offstream	Earth	11,400	30	3,100	240,600	1913
	Lake Alice, Lower	do	do		23	2,550	119,000	1912
	Minatare	do	do	[2] 60,800	63	3,700	696,160	1915
	Pathfinder	North Platte	Masonry arch-gravity	[2] 1,070,000	214	1,070	65,700	1909
	Pathfinder dike	do	Earth		38	1,650	152,200	1909

See footnotes at end of table.

TABLE 6.—Bureau of Reclamation storage dams—Continued

State and project	Name of dam	River	Type	Capacity	Height	Length	Volume	Year
Nevada:								
Humboldt	Rye Patch	Humboldt	Earth	[2] 179,000	80	914	356,300	1936
Newlands	Lahontan	Garson	Earth, power plant	[2] 273,600	162	5,400	733,100	1915
	Lake Tahoe [1]	Truckee	Concrete slab-and-buttress, lake outlet regulator.	[2] 732,000	16	109	430	1913
Nevada-California:								
Truckee River storage	Boca	Little Truckee	Earth	41,200	116	1,629	911,900	1939
New Mexico:								
Carlsbad	Alamogordo	Pecos	Earth and rockfill	156,800	148	3,084	1,914,900	1937
	Avalon [1]	do	Earth	7,000	58	1,025	202,300	1891
	McMillan	do	do	38,700	57	2,114	234,000	1894
	Fort Sumner	Pecos	Concrete	100	50	650	24,700	1951
New Mexico-Texas:								
Rio Grande	Caballo [1]	Rio Grande	do	345,900	112	4,558	1,244,200	1938
	Elephant Butte	do	Concrete gravity, power plant (1940).	[2] 2,219,000	301	1,674	629,500	1916
North Dakota:								
Heart (Missouri River Basin)	Heart Butte	Heart River	Earth	450,000	174	1,850	1,222,000	1949
	Dickinson	do	do	16,500	69	2,225	326,000	1950
Missouri-Souris (Missouri River Basin).	Jamestown	James	do	1,460	100	1,400	960,000	(4)
Oklahoma:								
W. C. Austin	Altus [1]	Red, North Fork	Concrete gravity, masonry-faced.	[2] 151,700	110	1,112	70,200	1945
Oregon:								
Baker	Thief Valley	Powder	Concrete slab-and-buttress	17,400	70	390	6,288	1932
Burnt River	Unity	Burnt	Earth, rock-faced	25,800	83	675	253,600	1938
Deschutes	Crane Prairie	Deschutes	Earth	55,300	36	285	29,700	1940
	Wickiup	do	do	180,000	100	13,860	1,852,000	1949
	Wickiup-East Dike	do	do		28	3,420		1949
Umatilla	Cold Springs	Offstream	do	[2] 50,000	117	3,450	793,400	1908
	McKay	McKay Creek	Earth, concrete-faced	[2] 73,800	180	2,700	2,363,800	1927
Vale	Agency Valley	Malheur, North Fork	Earth	59,900	110	1,850	645,300	1935
	Warm Springs	Malheur, Middle Fork	Concrete arch	192,400	106	469	19,500	1919
Oregon-California:								
Klamath	Clear Lake	Lost	Earth	527,000	39	840	63,400	1910
	Gerber	Miller Creek	Concrete arch	[2] 94,300	88	485	11,900	1925
	Link River	Link	Concrete slab-and-buttress, lake outlet regulator.	[2] 873,000	22	435	2,200	1921
Oregon-Idaho:								
Owyhee	Owyhee [1]	Owyhee	Concrete arch-gravity	1,120,000	417	833	537,500	1932
South Dakota:								
Cheyenne (Missouri River Basin).	Angostura	Cheyenne	Concrete gravity, embankment wing.	220,000	187	1,900	749,600	1949
Belle Fourche	Belle Fourche	Owl Creek	Earth, concrete faced	[2] 177,500	122	6,262	1,783,200	1911
Rapid Valley	Deerfield	Castle Creek	Earth	15,700	133	825	607,400	1947
Grand (Missouri River Basin).	Shadehill	Grand	do	467,000	145	1,900	3,500,000	1951

Texas:								
Colorado River	Marshall Ford	Colorado (Texas)	Concrete gravity, embankment wings, power plant.	1,951,300	278	5,093	3,579,000	194
Utah:								
Hyrum	Hyrum [1]	Little Bear	Earth	18,800	116	540	435,600	1935
Moon Lake	Midview	Offstream	do	5,800	54	663	138,900	1937
	Moon Lake	Lake Fork, West Fork	do	[2] 35,800	110	1,108	513,100	1938
Newton	Newton	Clarkson Creek	do	5,500	101	4,781	410,000	1946
Ogden River	Pine View	Ogden	do	43,600	103	480	267,700	1937
Provo River	Deer Creek	Provo	do	152,600	235	1,304	2,827,900	1941
Scofield Dam	Scofield	Price	do	73,000	125	575	202,700	1946
Strawberry Valley	Strawberry	Strawberry	do	283,000	79	488	117,900	1913
Weber River	Echo	Weber	do	73,900	158	1,887	1,539,800	1931
Washington:								
Columbia Basin	Grand Coulee	Columbia	Concrete gravity, 2 power plants and pumping plant.	9,517,000	550	4,173	10,585,000	1942
	South Coulee	Offstream	Earth	1,484,000	94	9,800	1,605,000	1949
	North Coulee	do	do		145	1,400	1,228,000	1951
	Long Lake	do	do	62,700	130	1,900	1,489,000	1948
	O'Sullivan	Lower Crab Creek	do	606,000	200	19,000	9,245,000	1949
Okanogan	Conconully	Salmon Creek	Earth, hydraulic fill	[2] 13,000	70	1,000	359,000	1910
	Salmon Lake	do	Earth	[2] 10,500	42	1,260	194,900	1921
Yakima	Bumping Lake	Bumping	do	37,300	45	3,660	252,600	1910
	Clear Creek	Tieton, North Fork	Concrete arch	5,300	80	404	5,800	1914
	Cle Elum	Cle Elum	Earth	529,200	135	750	1,411,300	1933
	Kachess	Kachess	do	[2] 239,000	114	1,400	199,600	1912
	Keechelus	Yakima	do	170,500	103	6,550	683,500	1917
	Tieton	Tieton	Earth, semihydraulic fill	[2] 197,000	235	920	2,048,600	1925
Wyoming:								
Boysen (Missouri River Basin)	Boysen	Big Horn	Earth, power plant	1,493,000	220	1,000	1,689,000	1952
Cheyenne (Missouri River Basin)	Keyhole	Belle Fourche	Earth	510,000	165	3,420	1,300,000	(4)
Eden	Big Sandy	Big Sandy Creek	do	65,000	80	2,300	840,000	(4)
Kendrick	Alcova [1]	North Platte	do	190,700	265	763	1,635,300	1938
	Seminoe	do	Concrete arch, power plant	[2] 1,026,000	295	530	210,200	1939
Oregon Trail (Missouri River Basin).	Kortes [3]	do	Concrete gravity, power plant	4,800	240	440	147,000	1951
Riverton	Bull Lake	Bull Lake Creek	Earth	[2] 152,000	81	3,456	819,600	1938
	Pilot Butte	Offstream	Earth, semihydraulic fill	[2] 31,600	51	1,300	135,300	1926
Wyoming-Montana:								
Shoshone	Deaver	do	Earth	680	14	1,300	30,300	1918
	Ralston	do	do	1,500	35	2,200	24,700	1908
	Buffalo Bill	Shoshone	Concrete arch, power plant	[2] 456,600	325	200	82,900	1910

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[1] Storage and diversion.
[2] Live storage—dead storage not evaluated.
[3] Power dam—water supply for generation of power.
[4] Under construction.
[5] Horsetooth Reservoir formed by 4 dams.
[6] Not available.

NOTES

Capacity: Acre-feet of reservoir storage provided by highest controlled water surface.

Height: Storage dams—feet between lowest point in foundation and normal crest of dam.

Length: Feet of barrier in dam and integral features constructed between natural abutments.

Volume: Cubic yards of all material in dam and its appurtenant features.

Year: Date original construction was completed.

FOREIGN ACTIVITIES

The Bureau of Reclamation again this year assumed an even greater role in the operation of the technical assistance programs of the United States. Each year since the end of the Second World War, the Bureau has received an increasing number of requests from abroad for technical services. In response, the Bureau, through the Office of Foreign Activities, has arranged to send technical personnel overseas, and has acted as host to trainees, official observers, and accredited visitors. Most of the work of this nature which the Bureau has done has been carried out in conjunction with the Technical Cooperation Administration of the Department of State under the terms of Pub. Law 400, 82d Cong., popularly referred to as the Point IV Law. Although the foreign technical assistance programs of the United States Government are directed primarily at benefiting other countries, the Bureau of Reclamation nevertheless profited a great deal from the resulting exchange of technical and general information about the development of water resources the world over.

During the last fiscal year, there were 33 missions overseas in 22 different countries involving 92 Bureau technicians. All of these technical assistance projects came about as a result of specific requests from the countries concerned and approved by the Department of State or by MSA. Under the point IV program, missions were sent to Costa Rica, Ecuador, Ethiopia, India, Iran, Iraq, Jordan, Lebanon, Liberia, Libya, Nicaragua, and Pakistan. Other Bureau personnel went on technical assistance assignments to Australia, Ceylon, Chile, and New Zealand under the provisions of Pub. Law 402, 80th Cong., to Italian Somaliland, Malaya, Northern Rhodesia, and Thailand for MSA, to the Virgin Islands for the Office of Territories, Department of the Interior, and to Saudi Arabia for the United Nations FAO. In fiscal year 1952, the Bureau received from the various agencies which direct the foreign assistance programs a total of $1,845,000 for its contribution to these programs. This amount contrasts vividly with the $247,000 which was paid to the Bureau for its participation in the program for the fiscal year 1951. In terms of newly irrigated acres and installed hydroelectric capacity, the Bureau in its foreign activities work is concerned with a program of water resource development which is larger than all it has done in the United States in the last 50 years.

During this past fiscal year, increased emphasis was placed on active participation by the Bureau of Reclamation in the various international meetings connected with the development of water resources. Bureau employees were sent as official United States delegates or observers to the following international conferences: World Power

Conference, Large Electric High-Tension Systems, International Commission on Large Dams, International Association of Hydraulic Research, United Nations Economic and Social Council Conference on Flood Control, International Geographical Union, and the Sixth International Grasslands Congress.

In November 1951, the Commissioner delivered a series of 16 lectures on the Administration and Execution of Natural Resources Development at the FAO Latin American Training Center in Santiago, Chile. Since that time, these lectures have been prepared for use by colleges and universities, and they have been translated into several foreign languages so that they might be employed in the point IV program overseas.

Continued efforts to establish a United States National Committee of the International Commission on Irrigation and Drainage met with success, and definite plans were made to hold the organizational meeting early in fiscal year 1953. The Bureau also accorded strong support to the United Nations Food and Agriculture Organization in its fight against world food shortages and in its land reform programs. The International Reclamation Conference was one of the high spots of the year. Planned by the Office of Foreign Activities, the meeting was attended by 30 high reclamation officials representing the governments of 24 nations. Papers were given on planning, construction, economics, and agriculture by the foremost authorities of the Bureau. The Columbia Basin was used as a laboratory, and this distinguished group of engineers and administrators participated in one of the most extensive and detailed examinations ever attempted of a basin development project.

The Bureau of Reclamation continues to play a very important part in the training of foreign nationals in water resource development. During fiscal year 1952, 350 foreign officials and engineers representing 60 nations toured various projects and visited Bureau field offices to observe Reclamation practices. Of this number, 71 were in-service trainees who studied engineering and administration in the Denver engineering offices and laboratories or at other Bureau installations. A number of Bureau trainees returned to their countries, and they are now working side by side with Bureau employees on point IV and other projects.

At the request of several foreign governments and with the approval of the Department of State, the Bureau performed testing, research, design review, and other similar services in connection with various development projects abroad. The Bureau is continuing to review for the Government of Thailand the design work for Chao Phya Dam which has been done in that country under the supervision of two Bureau men.

The exchange of technical and general information about the development of water resources continued at an increasing rate during fiscal year 1952. The Bureau received requests from foreign nationals for information, publications, photographs, and similar material. Insofar as facilities permitted, these materials were supplied. Exchanges of publications with the agencies of foreign governments also increased in volume.

For several months it has been evident that a central clearing house was needed to collect, compile, analyze, and correlate the available data on geography, topography, hydrology, water and land use, electric power, irrigation, water laws, land tenure, and related engineering practices of the world over. Data of this type have been continually in demand by other government agencies as well as by the personnel involved in the Bureau's own foreign program. In order to prepare personnel who were going abroad on technical missions, country reports were assembled on Chile, Ecuador, Ethiopia, and Peru. With the increasing need for material of this nature, a Branch of Technical Analysis was established in the Office of Foreign Activities to assemble data on all of the TCA countries. It is planned that the Branch of Technical Analysis will prepare additional country reports which, with the others, will be continually revised to insure the inclusion of all the latest available information. During fiscal year 1953, when the Branch of Technical Analysis has been completely staffed, it will be possible to increase the flow of water resources development information into this office through cooperation with the Foreign Service, correspondence with Bureau personnel overseas, and through continuing contacts with foreign engineers who have visited or have trained with the Bureau of Reclamation in the United States.

It is anticipated that there will be a further increase in the scope and magnitude of the part the Bureau of Reclamation will play in this Government's foreign technical assistance programs during the coming fiscal year. It is estimated that during fiscal year 1953, the cost of the technical services which the Bureau will be requested to supply will be in the neighborhood of $2,700,000. The Bureau's participation in these foreign aid projects will continue insofar as the domestic program will permit it, and as the funds are made available by the Technical Cooperation Administration and the other sponsoring agencies.

OPERATION AND MAINTENANCE

The Division of Operation and Maintenance is responsible for keeping irrigation water flowing down the ditch to 125,000 farms consisting of 6,713,000 acres on which 410,000 settlers live, as well as making certain that the irrigation facilities on 69 projects are kept in good repair to assure the best and most economical use of the water. These facilities include 108 storage and 71 diversion dams, more than 18,000 miles of canals and laterals, more than 5,500 miles of drains, 331 major pumping plants and an estimated 10,550 miles of operating roads.

Actually the Reclamation family numbers almost 2,000,000. In addition to the number of settlers on the projects, at least 1,500,000 persons living in nearby towns and villages are dependent on the Reclamation program.

Extension of Irrigation Service

Bureau facilities were extended in 1951 to make full or supplemental water service available to an additional 688,000 acres, making the total 6,713,000 irrigable acres, compared with 6,025,000 acres in 1950.

Acreages and number of new farms for all projects reporting new farms are shown in the following tabulation:[2]

Project or division of project	Irrigated	
	Number of farms	Acres
Boise project, Payette division, Second unit, Idaho	120	6, 746
Columbia Basin project, South district, Washington	21	1, 195
Deschutes project, North unit, Oregon	2	1, 053
Minidoka project, North Side pump, Idaho	37	3, 692
Yakima project, Roza division, Washington	144	6, 000
Central Valley project, California	507	53, 819
Klamath project, Oregon-California	3	465
Orland project, California	8	170
All-American canal system, Coachella division, California	186	[1] 12, 018
Gila project, Yuma Mesa division, Yuma Mesa unit, Arizona	9	1, 110
Mancos project, Colorado	4	516
Pine River project, Colorado	0	2, 260
Preston Bench project, Idaho	0	594
Tucumcari project, New Mexico	10	1, 755
Buford-Trenton project, North Dakota	3	465
Intake project, Montana	1	50
Lower Yellowstone project, District 1, Montana	0	25
Lower Yellowstone project, District 2, North Dakota	0	20
Missouri River Basin project, Heart division, Dickinson unit, North Dakota	3	143
Riverton project, Third division, Wyoming	60	5, 008
Shoshone project, Wyoming-Montana	0	4. 272
Kendrick project, Wyoming	19	2, 360
Mirage Flats project, Nebraska	2	238
Total	1, 139	103, 974

[1] Does not represent all new land. A portion of this acreage was previously irrigated from private wells.

Crop Production

Farmers on Reclamation projects raised crops with a new all-time all-high gross value, $821,722,000 or an increase of $243,484,000 over the 1950 return, the previous all-time high, which was $578,238,000. This marked the sixth consecutive year that crop values exceeded the half billion dollar mark and brought the cumulative value of Reclamation crops produced since 1906 to $7,983,529,000. This is approximately four times the amount invested in all Bureau projects to date. The average gross crop value per cultivated acre was $138.29 for 1951. This was an increase of $26.86 over the $111.43 average value for 1950 and marked the seventh successive year of average crop values in excess of $100 per acre.

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[2] Does not represent lands receiving supplemental water supply.

More than 22 million tons of food, forage, fiber, were produced on Reclamation lands in 1951 as compared with 16 million tons plus in 1950. Of the 1951 total, 4,674,267 tons consisted of fruits, nuts, vegetables, and pulses—the so-called protective food. The acreage distribution of crops shows that hay and forage constituted the largest acreage group with 41.5 percent of the total, followed by cereals with 22.7 percent, and cotton with 10.3 percent.

The irrigation of western desert lands makes possible the production of high value crop specialties. Among the top money makers were fresh market tomatoes on the Coachella division of the All-American Canal which grossed $2,500 per acre, strawberries on the Salt River averaged $2,200 per acre and a small acreage of hops on the Umatilla project averaged $1,980 per acre. Thirty-four projects or divisions of projects reported over 93,000 acres producing crops with values in excess of $500 an acre. Specialty crops grown on this acreage were valued at over $65,000,000.

The ability to produce this almost endless bounty year after year through a controlled and assured water supply will always remain one of the greatest attributes of Reclamation development. The types of crops raised on western irrigated lands include many products not available in other places in the United States and thus fall in the noncompetitive category.

Relative amounts of water supplied from Bureau works varied widely due to differences in crop requirements, rainfall, soils, extent to which adequate supplies from other sources exist, and other factors. The highest amount was reported on the Yuma Mesa division of the Gila project in Arizona where nearly 15 acre-feet per acre were delivered to farmers' headgates. The lowest average supply was furnished on the Malta division of the Milk River project in Montana where records show about one-half acre-foot per acre was supplied to Bureau works. Water supplies were generally adequate except in the Southwest where shortages were experienced on the Rio Grande, Carlsbad, and Salt River projects.

Land Openings

During the fiscal year 1952 the Bureau opened for settlement 12,351 acres, comprising 201 farm units on the Columbia Basin and the Gila projects. The farm units on the Columbia Basin project were sold under the provisions of the Columbia Basin project act, while the farm units on the Gila project were opened for homestead entry under the provisions of the Reclamation and Homestead laws. The land openings on the Columbia Basin included nine full-time farm units and 53 part-time farm units, comprising 694 acres of land in the Quincy Columbia Basin irrigation district, 80 farm units, comprising 4,759 acres in the East Columbia Basin irrigation district and 32 farm units, comprising 2,868 acres in the South Columbia Basin irrigation district. The opening on the Gila project involved 4,030 acres of land, comprising 27 farm units.

While the number of farm units opened to settlement during the fiscal year was slightly in excess of the number opened the previous year, the number of applications received for these farm units was greatly in excess of those received in former years. A total of 16,321 applications were received for the 148 family-sized farm units or an average of 110 applications per farm unit. A large proportion of the irrigation facilities now under construction or scheduled for future construction by the Bureau will serve privately owned lands. The amount of public or Government-acquired lands which is to be served by irrigation facilities is becoming relatively scarce, while the demand on the part of veterans for this land appears to be increasing. However, it is anticipated that in each of the next few years from 100 to 200 farm units will be available for settlement.

Credit for Settlers

Limited finances have always been and continue to be a problem for new settlers; however, the credit situation has been greatly alleviated during the past few years through loans made to new settlers on Reclamation projects by the Farmers Home Administration of the Department of Agriculture. Under the provisions of Public Law 361, Eighty-first Congress, the Farmers Home Administration can grant loans to entrymen prior to the time they obtain patent to the land. On several projects from 60 to 80 percent of the settlers have obtained loans from this source. The size of the individual loans ranged from $500 where water facilities only are involved to $20,000 or more where land development, housing and farm operating loans are granted. This increase in available credit has resulted in a more rapid development of the new farm units. Whereas it formerly required a number of years to bring a new farm under irrigation development, many new settlers have developed 80 percent or more of their irrigable area by the end of the second year.

Excellent cooperation exists between the Bureau of Reclamatio and the Farmers Home Administration, and the Bureau has worke closely with the Administration in supplying it with information relative to land which is to be opened for settlement and in assisting i in estimating the credit needs of new settlers.

Development Farms

Sixteen development farms have been established in new irrigate areas of the Columbia Basin, Missouri Basin, Gila, and Riverton projects to determine and demonstrate, for the benefit of new irrigatio farmers, the most efficient methods of irrigation, the best croppin practices and the crops best adapted to these areas. Five of thes farms were established during the year.

A part of each farm is generally devoted to research which is conducted by State experiment stations and U. S. Department of Agriculture agencies on water use, fertilizers, crops, and other subjects Field days and tours are conducted on the farms each year for th benefit of the new settlers. The findings of the research are reporte annually and already have proved of great value to the new farmer in these areas. The development farms are established as far as possible in advance of irrigation on the project so information will b available when the settlers start to cultivate and irrigate their lands

Repayment and Water Service Contracts

A fundamental principle of Reclamation law is that the cost of project construction be repaid by the water users and other beneficiaries In keeping with that principle, during fiscal year 1952 repaymen contracts having a face value totalling $90,513,600 were entered int with 12 irrigation districts to assure the return of the cost of construction of irrigation works on new projects. In addition, delivery o water to 6 new contracting entities is provided for by water servic type contracts executed during the year with various irrigation districts and municipalities. Further substantial progress was mad during the year, pursuant to sections 4 and 7 of the Reclamation Project Act of 1939, in modifying repayment contracts with irrigatio districts in financial difficulties to assure sound repayment arrangements based on economic and land classification surveys. Amendatory repayment contracts were entered into with 22 irrigatio districts on 7 Federal reclamation projects involving the repaymen of some $45,170,000. The Congressional approval necessary in connection with the amendatory contracts with 18 of the 22 irrigatio districts was provided in specific legislation enacted during the year

In accordance with the act of October 7, 1949, as amended, reimbursement of the cost of rehabilitation and betterment work was provided for in contracts negotiated with 4 irrigation districts in the total amount of $1,796,000.

Rehabilitation and Betterment

The rehabilitation and betterment program of the Bureau of Reclamation was continued during fiscal year 1952 in order to take care of extensive items of deferred maintenance on some of the older Reclamation projects. This program, in accordance with the act of October 7, 1949, as amended, requires full reimbursement by the water users of all funds expended.

A total of $2,852,450 appropriated by the Congress for this work during the year was allotted to eleven projects. All work contemplated under the rehabilitation and betterment program for accomplishment of the Grand Valley project, in Colorado, and the Yakima project, in Washington, was substantially completed by June 30, 1952.

The work on the various projects included replacement of old wood structures; repair or replacement of old concrete and steel structures; cleaning and repair of canals, laterals, wasteways, and drains, installation of canal lining to prevent excessive water losses; construction of drains; and the construction and repair of operating roads, cattle guards, fences, and many other items as required to place the projects in first-class operating condition.

Soil and Moisture Conservation Operations

Under the Bureau's program of soil and moisture conservation operations, efforts were continued on the control of erosion on public lands under Reclamation jurisdiction; protection of reservoirs, canals, and other irrigation works from siltation; and prevention of water losses detrimental to irrigation projects.

This work is accomplished throughout the 17 Western States by individual effort of the Bureau of Reclamation and through effective cooperation with all other interested agencies in each of the areas concerned, particularly with the Bureau of Land Management, the Bureau of Indian Affairs, the Forest Service, the Soil Conservation Service, and soil conservation districts.

Representative of these activities are the stabilization and conservation of public lands in the Columbia Basin, and on watershed areas tributary to reservoirs of the Central Valley project, through revegetation, structures, etc.; the cooperative program with the Bureau of Land Management for control of erosion in the Book Cliffs area, Colorado, for benefit of public lands and protection of Reclamation structures of the Grand Valley project; construction for control of erosion for protection of the main canal and structures of the Rio Grande project, New Mexico; and increased construction for prevention of further erosion of Five Mile and Muddy Creeks above the Boysen Reservoir in Wyoming.

Drainage

One major area of maintenance not yet fully current, and which may become increasingly critical, is the improvement of project drainage and seepage control. In recent years, there has been general intensification of drainage activities on older projects. Cleaning and improvement of existing drains and extension of the system to additional areas has been a paying proposition in these years of high farm prices. On older projects, canal lining, in a number of cases is being used with good effect to reduce seepage.

A number of the projects now in the construction program present especially important drainage problems. In some cases, these new projects include substantial areas of soil that is easy to waterlog and difficult to drain. In certain other cases, the terrain aggravates difficulties of waste water and surface runoff disposal. In a large number of cases, the costs of drainage construction and maintenance are a major problem of project finances.

To a major extent, drainage can be provided only after a period of actual irrigation. Generally, a good system of the ground water level observation has been established on all projects. Close collaboration of the Chief Engineer, Operation and Maintenance, and the regional and project staffs provides ready attention to technical drainage problems as they develop. By and large, however, progress is slow in improvement of the use of water which often is a major cause o seepage.

Lower Cost Canal-Lining Program

This special investigations program, aimed at a determination o materials, methods, and procedures that will result in the most economical canal linings, was initiated in 1946. The investigations hav included laboratory work in Denver and experimental field installations. The work was continued during the past year by the Burea of Reclamation directly and by utilization of the resources and experience of State colleges and the Soil Conservation Service, in cooperative studies.

Utilization of the findings and developments under this program in design and construction of new projects and in rehabilitation and betterment of older, existing projects has resulted in definite worth-while savings to the Government.

Evidence that costs of canal linings have been materially reduced and economical seepage control obtained in spite of general rising construction costs may be found in the construction records and records of bid prices over the past 6 years. In 1946, the bid price of 3- to 4-inch thick reinforced concrete lining averaged close to $3 per square yard. In 1949 and 1950, the average bid price of the same thickness of unreinforced concrete lining was about $2.20 per square yard, and reports from the projects indicate that some 3-inch linings were actually being placed by Government forces in small laterals and farm ditches with subgrade-guided slip-forms for as little as $1.13 per square yard. On the Delta-Mendota canal in California, an estimated saving of $2,850,000 resulted from elimination of reinforcing steel in the concrete linings of that job alone. Costs of many miles of concrete and other hard-surface types of lining in the Central Valley, Columbia Basin, Gila, and other projects have been similarly reduced.

Progress of the investigations was reported in a bulletin titled, "Canal Linings and Methods of Reducing Costs" that is available to the general public through the Superintendent of Documents, U. S. Government Printing Office.

Weed Control

During the 50-year history of the Bureau of Reclamation perhaps no greater advancement in any operation and maintenance activity has been achieved than in the control of weeds on irrigation systems. The hand scythe, hoe and mattock, and horse-drawn mowers, with their labor-consuming, expensive, temporary results are a far cry from the specialized efficient equipment and the methods of control developed, especially during the past decade. These new methods have resulted in materially reducing the weed problems and water losses, and are annually saving many hundreds of thousands of dollars to the Government and the water users..

Many of these methods have been developed as a result of our cooperation with the Bureau of Plant Industry Soils and Agricultural Engineering, Department of Agriculture, and with State colleges. The BPISAE has stationed a plant physiologist at our Denver laboratory to work with Bureau of Reclamation chemists and weed specialists and has established four weed-control stations in the West. Perhaps the most outstanding development made in the Denver weed laboratory was the adaptation of aromatic solvents for controlling water weeds which, if uncontrolled, choke irrigation channels. Working out methods and equipment for applying 2, 4–D to ditchbanks has solved the serious willow problem as well as giving control of annual weeds which impede the flow of water, cause large losses of water through transpiration and create other operation problems This new chemical is also being tested in the Southwest for the control of salt cedar (tamarisk) which has spread throughout that area and has caused considerable concern because of its encroachment on range and other areas, the potential flood hazard it creates and its enormous waste of water through transpiration.

The use of TCA and IPC for controlling grass weeds is being demonstrated on many projects. Special aromatic oils for controlling Johnson grass is showing promise in the Southwest. Rosin amine D acetate is being used to solve some of our algae problems. Other new herbicides like CMU are coming in for their share of research to adapt them to the control of other weeds.

Active participation has been maintained in the inter-departmental weed control committee, composed of agencies of the Departments of the Interior and Agriculture, and which has as its function the exchange of weed control information and the coordination of weed control programs to prevent duplication of activities.

The grass-planting program on ditchbanks has been continued to prevent future weed problems and to furnish extra pasture for project farmers' livestock. Grasses use less water than most weeds, they prevent erosion of ditchbanks and are excellent weed competitors. A systematic program of seeding grasses has been formulated with the aim of establishing a grass sod on all projects as soon as possible after contruction is completed. Maintenance costs and water losses due to weeds have been reduced to a minimum where this practice has been followed.

The new poisonous weed halogeton has been found in a few area on lands under the Bureau's jurisdiction. Plans have been made to cooperate with other agencies in the control of this weed under the authority of the Halogeton Glomeratus Control Act which was approved by the President on July 14, 1952.

Recreational Use of Reservoirs

Construction of dams and reservoirs for irrigation and power development provides incidental but very definite benefits to the publi through the creation of exceptional recreational opportunities. Thi is particularly true in the more arid parts of the West.

Except in the Missouri River Basin, the Bureau of Reclamation i not authorized to expend funds for recreational development of reser voir areas. At certain reservoirs where recreational possibilities are deemed to be of national significance, such as Lake Mead, on the Colorado River between Arizona and Nevada; Franklin D. Roosevelt Lake, on the Columbia River in Washington; Millerton Lake, on the San Joaquin River in California; and Shadow Mountain and Granby Lakes on the Colorado River in Colorado, responsibility for the development and administration of recreational facilities has been delegated to the National Park Service. At certain other reservoirs which are located within the National Forest boundaries, recreational facilities are administered by the United States Forest Service.

There is an urgent need for legislation to provide authorization for the expenditure of nonreimbursable funds for the coordinated planning, development, and administration of the recreational resources at Reclamation dams and reservoirs.

During the past year, the Bureau of Reclamation also worked closely with the Fish and Wildlife Service and with the various State fish and game agencies for the protection, and where possible, enhancement of fish and wildlife values at reservoirs and on project lands.

In response to the request of the Chairman of the House Committee on Interior and Insular Affairs, a special report was prepared and published, in a 63-page booklet, outlining some of the significant values to recreation and fish and wildlife conservation that have resulted from developments of the Bureau of Reclamation throughout the 17 Western States.

Flood Control Operations

During recent years, the flood control functions of Bureau reservoirs have added new operating responsibilities. During the past year there was serious flood threat on virtually every stream on which there is a Bureau reservoir, with the exception of the Rio Grande and the Pecos Rivers. By the high caliber performance of the field officials, reservoir operations in the spring throttled down flood crests with significant reduction of flood damages.

In region 1 in spite of the unusual amount of snow cover, Bureau operations on the upper Snake River held the discharge at Heise to 26,000 cubic feet per second, well below the normal flood stage. In region 2, on the Sacramento River, with record snow storage above Shasta reservoir, the spring floods were completely controlled, leaving the reservoir full without spill. In region 6, the new Shadehill Dam, barely finished, completely contained a flood of record, significantly minimizing damage to downstream areas. Floods, particularly in the Salt Lake City area, and also along the Humboldt River, required very complicated control operations this spring.

The impressive summary of the spring's flood control operations emphasizes the importance of this function and forecasts that in the years ahead it will increase.

Associated with reservoir operations is channel work such as performed in region 3 under the Colorado River Front Work and Levee Act. Those operations have the primary objective of correcting or preventing damage associated with downstream effects of reservoir storage and releases. The first major reach of new channel was completed a year ago and it has functioned satisfactorily since. Improvement of the second reach of channel is still in progress.

Cooperation With Design and Construction

Operation and maintenance activities have been essentially of a cooperative character. Basically, they depend on cooperation with the water users. There also is continued need for cooperation with the construction forces to assure that project facilities will meet operating requirements with maximum feasible efficiency and economy.

Each year it is gratifying to report increasingly close collaboration between the experienced operation and maintenance personnel who operate the existing projects and the design and construction staff who are building the new ones.

Cooperation With Agricultural Agencies

Another important field of cooperative work is with the agricultural agencies. The Bureau's working relations with the State colleges and extension services and with the agencies of the Federal Department of Agriculture have continued to improve. During the year, 51 memoranda of understanding or cooperative agreements with State colleges or other agencies were executed. This brings the total of agreements now in effect to 151. In the field and in national gatherings such as the Association of Land Grant Colleges and Universities, Bureau representatives have been welcomed as working partners. In turn, the Bureau is utilizing the agricultural agencies increasingly for specialized technical information and for assistance to settlers in new irrigation areas. The joint program on the Columbia Basin project is an outstanding example for all time of close teamwork to bring about maximum early development of project lands.

Federal Tax Revenues from Reclamation Areas

The increase in the wealth of the Nation through Reclamation development can be measured in part by the direct contribution of reclamation projects to the national treasury. Payments on the construction account by project water users or revenues from the sale of hydroelectric power are obvious expressions of this phenomenon. The greatest single contribution of Reclamation projects, however, is through the payment of the various Federal taxes by the recipients of project benefits rather than through deposits made by them in the liquidation of some specific contractual obligation.

Income taxes paid into the Federal Treasury directly or indirectly as a result of Reclamation development since 1916 on fifteen selected project areas represent a return of over 3½ times the total Federal construction cost of these units. These Federal tax revenues in a sense constitute a return on the Federal investment in addition to the repayment of construction costs. Significantly, much of the area included in Reclamation projects would have produced little or no Federal tax revenues in their native States. Much of the land now irrigated would have remained a part of the great American desert and, if used for grazing or pasture purposes, would have only meager net income per acre.

Total Federal tax revenues from all Reclamation projects providing a full or supplemental irrigation water supply based on a projection of the 15-project analysis now exceed 2.5 billion dollars. The effect of major Reclamation projects, such as the Columbia Basin, Colorado-Big Thompson, Missouri Basin, and the Central Valley, on Federal tax revenues will not be felt for many years to come.

TABLE 7.—Projects in operation—Irrigation and crop value data for the calendar year 1951

State, project, and subdivision	Projects entirely constructed by the Bureau								Projects furnished supplemental storage water from works constructed by the Bureau				
	Irrigable area [1]	Irrigated area	Land subject to construction charges			Temporarily suspended land [2]			Irrigable area [1]	Irrigated area	Net area in cultivation	Crop values	
			Net area in cultivation	Crop values		Net area in cultivation	Total crop values	Value per acre				Total	Per acre
				Total	Per acre								
REGION 1													
Idaho													
	Acres	*Acres*	*Acres*	*Dollars*	*Dollars*	*Acres*	*Dollars*	*Dollars*	*Acres*	*Acres*	*Acres*	*Dollars*	*Dollars*
Lewiston Orchards [3]	3, 504	2, 715	2, 681	561, 655	209. 49	34							
Minidoka:													
American Falls reservoir district No. 2	98, 462	90, 744	90, 744	6, 679, 495	73. 61								
Burley irrigation district	47, 937	44, 511	44, 511	4, 693, 199	105. 44								
Fremont-Madison irrigation district									112, 000	103, 608	103, 608	6, 865, 263	66. 26
Minidoka irrigation district	71, 882	62, 212	62, 212	6, 059, 097	97. 39								
Leased and water rental lands													
Warren Act contractors													
Total—Minidoka project	218, 281	197, 467	197, 467	17, 431, 791	88. 28				112, 000	103, 608	103, 608	6, 865, 263	66. 26H
Rathdrum Prairie:													
Hayden Lake unit [3]	1, 087	510	557	42, 157	75. 69								
Post Falls unit [3] [4]	3, 109	2, 417	2, 699	188, 253	69. 75								
Total—Rathdrum Prairie project	4, 196	2, 927	3, 256	230, 410	70. 76								
Idaho-Oregon													
Boise:													
Big Bend irrigation district (Oregon)	1, 721	1, 487	1, 487	107, 457	72. 26								
Black Canyon irrigation district—unit 1	6, 880	6, 602	6, 602	1, 045, 685	158. 39								
Black Canyon irrigation district—unit 2	51, 760	41, 009	41, 009	2, 596, 720	63. 32								
Boise-Kuna irrigation district	48, 544	45, 529	45, 529	4, 322, 382	94. 94								
Nampa and Meridian irrigation district	40, 262	34, 551	34, 551	3, 291, 649	95. 27								
New York irrigation district	17, 826	14, 573	14, 573	819, 930	56. 26								
Settlers irrigation district	518												

Wilder irrigation district	56, 490	50, 399	50, 399	7, 497, 945	148. 77								
Warren Act contractors													
Total—Boise project	224, 001	194, 150	194, 150	19, 681, 768	101. 37								
Montana													
Bitter Root [3]	16, 665	16, 309	16, 309	570, 991	35. 01								
Frenchtown	4, 935	3, 027	3, 027	174, 954	57. 80								
Missoula Valley [4]	977	440	492	13, 335	27. 10								
Oregon													
Arnold [3]									4, 315	2, 988	3, 267	226, 055	69. 19
Baker									7, 312	7, 305	7, 305	299, 230	40. 96
Burnt River									15, 291	15, 240	15, 240	650, 840	42. 71
Deschutes:													
Central Oregon irrigation district									46, 713	43, 082	43, 082	5, 149, 805	119. 53
Lone Pine irrigation district													
North unit	50, 000	47, 009	47, 582	7, 937, 791	166. 82								
Total—Deschutes project	50, 000	47, 009	47, 582	7, 937, 791	166. 82				46, 713	43, 082	43, 082	5, 149, 805	119. 53
Grants Pass									10, 350	7, 414	7, 544	884, 341	117. 22
Ochoco													
Umatilla:													
East division	10, 911	6, 793	6, 793	402, 489	59. 25								
West division	7, 223	4, 908	5, 273	221, 903	42. 08								
South division:													
Stanfield irrigation district [3]									6, 000	5, 168	5, 229	555, 571	106. 25
Westland irrigation district									8, 352	5, 111	5, 111	266, 681	52. 18
Total—Umatilla project	18, 134	11, 701	12, 066	624, 392	51. 75				14, 352	10, 279	10, 340	822, 252	79. 52
Vale	32, 000	30, 910	30, 910	2, 627, 064	84. 99								
Oregon-Idaho													
Owyhee:													
Advancement irrigation district	700	628	628	82, 636	131. 59								
Bench irrigation district	2, 319	2, 222	2, 222	578, 307	260. 26								
Crystal irrigation district	1, 280	1, 129	1, 129	265, 190	234. 89								
Gem irrigation district (Idaho)	33, 342	31, 075	30, 254	3, 430, 885	113. 40	821	31, 549	38. 43					
Ontario-Nyssa irrigation district	5, 831	5, 707	5, 707	965, 380	169. 16								
Owyhee irrigation district	55, 826	52, 476	52, 142	5, 374, 002	103. 06	334	12, 314	36. 87					
Payette-Oregon Slope irrigation district	4, 684	4, 367	4, 354	1, 083, 846	248. 93	13	344	26. 46					
Slide irrigation district	1, 144	1, 089	1, 089	131, 049	120. 34								
Warren Act contractors													
Total—Owyhee project	105, 126	98, 693	97, 525	11, 911, 295	122. 14	1, 168	44, 207	37. 85					

See footnotes at end of table.

TABLE 7.—Projects in operation—Irrigation and crop value data for the calendar year 1951—Continued

State, project, and subdivision	Projects entirely constructed by the Bureau								Projects furnished supplemental storage water from works constructed by the Bureau				
	Irrigable area [1]	Irrigated area	Land subject to construction charges			Temporarily suspended land [2]			Irrigable area [1]	Irrigated area	Net area in cultivation	Crop values	
			Net area in cultivation	Crop values		Net area in cultivation	Total crop values	Value per acre				Total	Per acre
				Total	Per acre								
REGION 1—continued													
Washington	*Acres*	*Acres*	*Acres*	*Dollars*	*Dollars*	*Acres*	*Dollars*	*Dollars*	*Acres*	*Acres*	*Acres*	*Dollars*	*Dollars*
Columbia Basin:													
East Columbia Basin irrigation district	80	77	77	24,035	312.14								
Quincy-Columbia Basin irrigation district	211	174	174	16,332	93.86								
South Columbia Basin irrigation district	6,624	5,084	5,084	698,457	137.38								
Total—Columbia Basin project	6,915	5,335	5,335	738,824	138.49								
Okanogan	5,342	3,514	3,514	1,127,133	320.75								
Yakima:													
Kittitas division	59,610	54,501	54,381	3,169,270	58.28	120	2,400	20.00					
Roza division	72,185	57,818	57,813	12,163,531	210.39	5	125	25.00					
Sunnyside division	103,579	79,942	80,984	13,403,749	165.51	375	45,498	121.33					
Tieton division	27,271	24,523	24,736	12,926,752	522.59								
Warren Act contractors													
Total—Yakima project	262,645	216,784	217,914	41,663,302	191.19	500	48,023	96.05					
Total—Region 1	952,721	830,981	832,228	105,294,705	126.52	1,702	92,230	54.19	210,333	189,916	190,386	14,897,786	78.25
REGION 2													
California													
Central Valley [5]													
Orland	19,375	17,130	17,130	1,821,803	106.35								

Oregon-California													
Klamath:													
Main division (Oregon)	41, 082	35, 052	32, 223	4, 732, 879	146. 88	2, 829	121, 418	42. 92					
Tule Lake division (California)	44, 287	42, 557	42, 769	8, 108, 947	189. 60	51	3, 707	72. 69					
Leased and water rental lands													
Warren Act contractors													
Total—Klamath project	85, 369	77, 609	74, 992	12, 841, 826	171. 24	2, 880	125, 125	43. 45					
Total—Region 2	104, 744	94, 739	92, 122	14, 663, 629	159. 18	2, 880	125, 125	43. 45					
REGION 3													
Arizona													
Gila—Yuma Mesa division:													
North Gila unit	7, 287	6, 224	6, 224	1, 420, 987	228. 31								
South Gila unit													
Yuma Mesa unit	20, 251	8, 177	8, 177	1, 285, 255	157. 18								
Total—Gila project	27, 538	14, 401	14, 401	2, 706, 242	187. 92								
Salt River	238, 907	213, 821	224, 257	64, 928, 827	289. 53								
Arizona-California													
Yuma—Reservation Division:													
Indian lands (California)	7, 743	3, 383	3, 383	689, 861	203. 92								
Bard irrigation district (California)	7, 048	5, 922	5, 922	983, 168	166. 02								
Valley division (Arizona)	52, 991	46, 128	45, 728	13, 133, 301	287. 20	400	37, 390	93. 48					
Yuma auxiliary (unit B) (Arizona)	3, 377	2, 144	2, 144	694, 056	323. 72								
Total—Yuma project	71, 159	57, 577	57, 177	15, 500, 386	271. 09	400	37, 390	93. 48					
California													
All-American Canal:													
Coachella division	60, 715	33, 489	33, 489	18, 777, 683	560. 71								
Imperial division [6]													
Total—Region 3	398, 319	319, 288	329, 324	101, 913, 138	309. 46	400	37, 390	93. 48					

See footnotes at end of table.

TABLE 7.—Projects in operation—Irrigation and crop value data for the calendar year 1951—Continued

State, project, and subdivision	Projects entirely constructed by the Bureau								Projects furnished supplemental storage water from works constructed by the Bureau				
	Irrigable area [1]	Irrigated area	Land subject to construction charges			Temporarily suspended land[1]			Irrigable area [1]	Irrigated area	Net area in cultivation	Crop values	
			Net area in cultivation	Crop values: Total	Crop values: Per acre	Net area in cultivation	Total crop values	Value per acre				Total	Per acre
REGION 4													
Colorado	*Acres*	*Acres*	*Acres*	*Dollars*	*Dollars*	*Acres*	*Dollars*	*Dollars*	*Acres*	*Acres*	*Acres*	*Dollars*	*Dollars*
Fruitgrowers Dam [3]									2,662	2,099	2,099	280,237	133.51
Paonia [3]	11,500	10,063	10,063	1,012,007	100.57								
Grand Valley:													
Garfield Gravity division	30,444	21,297	19,067	1,812,467	95.06	2,230	92,123	41.31					
Orchard Mesa division [3]	10,027	8,138	8,138	1,829,192	224.77								
Warren Act contractors													
Total—Grand Valley project	40,471	29,435	27,205	3,641,659	133.86	2,230	92,123	41.31					
Mancos [4]									8,592	7,363	7,389	367,060	49.68
Pine River									35,812	33,899	33,899	1,143,665	33.74
Pine River Indian irrigation									9,493	9,273	9,273	333,757	35.99
Uncompahgre	71,969	57,349	57,349	5,315,764	92.69								
Idaho													
Preston Bench [3]									6,660	4,744	4,744	388,840	81.96
Nevada													
Humboldt									40,012	25,438	25,438	1,811,494	71.21
Newlands:													
North Carson division	7,153	4,094	4,037	306,764	75.99	80	800	10.00					
South Carson division	57,805	44,608	43,639	1,855,884	42.53	1,482	14,820	10.00					
Truckee division	7,178	4,649	4,641	293,392	63.22	27	270	10.00					
Total—Newlands project	72,136	53,351	52,317	2,456,040	46.95	1,589	15,890	10.00					
Truckee Storage									28,793	24,296	24,296	2,232,740	91.90

Utah													
Hyrum									6,475	5,674	5,674	385,629	67.96
Moon Lake									75,233	58,380	58,729	1,544,064	26.29
Newton [4]									2,552	1,962	1,962	142,971	72.87
Ogden River									22,861	15,946	15,964	2,060,767	129.09
Provo River: Deer Creek division									46,609	39,577	40,680	4,605,399	113.21
Sanpete:													
Ephraim division									7,630	6,448	7,133	246,198	34.52
Spring City division									6,023	4,926	5,778	172,438	29.84
Total—Sanpete project									13,653	11,374	12,911	418,636	32.42
Scofield [4]									14,754	14,090	14,154	991,570	70.06
Strawberry Valley:													
High Line division	17,745	15,942	15,942	919,572	57.68								
Spanish Fork division	13,755	13,289	13,289	1,174,570	88.39								
Springville—Mapleton division	8,569	8,031	8,031	629,108	78.33								
Total—Strawberry Valley project	40,069	37,262	37,262	2,723,250	73.08								
Weber River									108,817	90,762	90,817	11,786,522	129.78
Total—Region 4	236,145	187,460	184,196	15,148,720	82.24	3,819	108,013	28.28	422,978	344,877	348,029	28,493,351	81.87
REGION 5													
Oklahoma													
W. C. Austin	47,810	46,322	46,322	5,160,452	111.40								
New Mexico													
Carlsbad	25,055	24,717	24,717	4,451,096	180.08								
Fort Sumner [3]	6,500	5,188	5,188	485,959	93.67								
Tucumcari	42,214	33,318	33,318	1,978,029	59.37								
New Mexico–Texas													
Rio Grande:													
Elephant Butte irrigation district (New Mexico)	88,000	90,608	84,638	23,156,593	273.60	5,991	1,392,113	232.37					
El Paso County water improvement district No. 1 (Texas)	67,000	66,166	62,715	20,312,385	323.88	3,451	981,399	284.38					
Hudspeth County conservation and reclamation district No. 1													
Total—Rio Grande project [7]	155,000	156,774	147,353	43,468,978	295.00	9,442	2,373,512	251.38					
Texas													
Balmorhea [4]									10,191	8,086	8,086	1,168,935	144.56
Total—Region 5	276,579	266,319	256,898	55,544,514	216.21	9,442	2,373,512	251.38	10,191	8,086	8,086	1,168,935	144.56

See footnotes at end of table.

TABLE 7.—Projects in operation—Irrigation and crop value data for the calendar year 1951—Continued

State, project, and subdivision	Projects entirely constructed by the Bureau								Projects furnished supplemental storage water from works constructed by the Bureau				
	Irrigable area [1]	Irrigated area	Land subject to construction charges			Temporarily suspended land [2]			Irrigable area [1]	Irrigated area	Net area in cultivation	Crop values	
			Net area in cultivation	Crop values		Net area in cultivation	Total crop values	Value per acre				Total	Per acre
				Total	Per acre								
REGION 6													
Montana													
Buffalo Rapids:	*Acres*	*Acres*	*Acres*	*Dollars*	*Dollars*	*Acres*	*Dollars*	*Dollars*	*Acres*	*Acres*	*Acres*	*Dollars*	*Dollars*
First division [4]	13,916	13,344	13,344	822,949	61.67								
Second division [4]	8,608	8,351	8,351	387,671	46.42								
Leased and water rental lands													
Total—Buffalo Rapids project	22,524	21,695	21,695	1,210,620	52.80								
Huntley	32,508	24,843	16,991	1,066,319	69.76	7,852	280,568	35.73					
Intake [4]	881	473	473	25,294	53.48								
Milk River:													
Chinook division	43,484	27,710	28,138	1,482,121	53.67								
Dodson Pumping unit [4]	1,180	1,180	1,180	47,062	39.88								
Glasgow division	19,407	11,679	10,411	360,211	34.60	1,486	44,056	29.65					
Malta division	53,733	27,129	17,301	679,206	39.26	10,159	193,203	19.02					
Pump lands	6,237	6,105	6,237	368,612	59.10								
Total—Milk River project	124,041	73,803	63,267	2,937,212	46.43	11,645	237,259	20.37					
Missouri River Basin project:													
Yellowstone division—Savage unit	2,216	1,940	1,940	62,720	32.33								
Sun River:													
Fort Shaw division	13,902	8,159	8,389	244,748	29.17	145	3,843	26.50					
Greenfields division	83,373	68,497	77,276	2,197,184	28.43								
Total—Sun River project	97,275	76,656	85,665	2,441,932	28.51	145	3,843	26.50					

Montana-North Dakota													
Lower Yellowstone:													
District No. 1 (Montana)	37, 272	32, 972	32, 810	1, 855, 520	56. 55	205	8, 922	43. 52					
District No. 2 (North Dakota)	19, 928	16, 573	16, 413	922, 352	56. 20	176	7, 659	43. 52					
Leased and water rental lands													
Total—Lower Yellowstone project	57, 200	49, 545	49, 223	2, 777, 872	56. 43	381	16, 581	43. 52					
North Dakota													
Buford-Trenton [4]	8, 199	8, 003	8, 003	395. 489	49. 42								
South Dakota													
Belle Fourche	59, 129	54, 137	54, 137	2. 327, 526	42. 99	26	610	23. 46					
Rapid Valley [4]									8, 900	7, 101	7, 101	226, 973	31. 96
Wyoming													
Riverton:													
Midvale irrigation district	48, 628	42 763	42, 763	1, 928, 112	45. 09								
Third division	12, 671	9, 263	9, 263	294, 682	31. 81								
Warren Act contractors													
Total—Riverton project	61. 299	52, 026	52. 026	2 222. 794	42 72								
Wyoming-Montana													
Shoshone:													
Frannie division	20, 083	10, 282	10, 018	343, 411	34. 28	264	5, 291	20. 04					
Garland division	41, 627	34, 176	32. 861	1, 554, 588	47. 31	1, 315	18, 380	13. 98					
Heart Mountain division	25, 182	21, 407	21, 360	1, 085, 972	50. 84	47	745	15. 85					
Willwood division	11, 426	10, 155	10, 155	481, 453	47. 41								
Leased and water rental lands													
Total—Shoshone project	98, 318	76, 020	74, 394	3, 465, 424	46. 58	1, 626	24, 416	15. 02					
Total—Region 6	563, 590	439, 141	427. 814	18. 933. 202	44. 26	21, 675	563. 277	25. 99	8, 900	7, 101	7, 101	226. 973	31. 96
REGION 7													
Colorado													
Colorado-Big Thompson									615, 000	615, 000	615, 000	63, 300, 517	102. 93
Nebraska													
Mirage Flats [4]	11, 659	11, 331	11, 331	688, 077	60. 73								

See footnotes at end of table.

TABLE 7.—Projects in operation—Irrigation and crop value data for the calendar year 1951—Continued

State, project, and subdivision	Projects entirely constructed by the Bureau								Projects furnished supplemental storage water from works constructed by the Bureau				
	Irrigable area [1]	Irrigated area	Land subject to construction charges			Temporarily suspended land [2]							
			Net area in cultivation	Crop values		Net area in cultivation	Total crop values	Value per acre	Irrigable area [1]	Irrigated area	Net area in cultivation	Crop values	
				Total	Per acre							Total	Per acre
REGION 7—continued													
Nebraska-Wyoming													
North Platte:	*Acres*	*Acres*	*Acres*	*Dollars*	*Dollars*	*Acres*	*Dollars*	*Dollars*	*Acres*	*Acres*	*Acres*	*Dollars*	*Dollars*
Gering-Fort Laramie irrigation district	54, 845	52, 780	52, 780	4, 772, 925	90. 43	------	------	------	------	------	------	------	------
Goshen irrigation district (Wyoming)	52, 484	48, 038	48, 038	3, 746, 764	78. 00	------	------	------	------	------	------	------	------
Northport irrigation district	13, 615	13, 518	13, 518	409, 266	30. 28	------	------	------	------	------	------	------	------
Pathfinder irrigation district	102, 824	87, 535	87, 535	4, 357, 821	49. 78	------	------	------	------	------	------	------	------
Leased and water rental lands	------	------	------	------	------	------	------	------	------	------	------	------	------
Warren Act contractors	------	------	------	------	------	------	------	------	------	------	------	------	------
Total—North Platte project	223, 768	201, 871	201, 871	13, 286, 776	65. 82	------	------	------	------	------	------	------	------
Wyoming													
Kendrick	14, 482	9, 341	9, 341	346, 767	37. 12	------	------	------	------	------	------	------	------
Total—Region 7	249, 909	222, 543	222, 543	14, 321, 620	64. 35	------	------	------	615, 000	615, 000	615, 000	63, 300, 517	102. 93

State, project, and subdivision	Special and Warren Act contractors receiving water from Bureau-constructed works					Leased and water rental lands receiving water from Bureau-constructed works				Entire area receiving full or supplemental water from Bureau-constructed works				
	Irrigable area [1]	Irrigated area	Net area in cultivation	Crop values		Irrigated area	Net area in cultivation	Crop values		Irrigable area [1]	Irrigated area	Net area in cultivation	Crop values	
				Total	Per acre			Total	Per acre				Total	Per acre
REGION 1														
Idaho	Acres	Acres	Acres	Dollars	Dollars	Acres	Acres	Dollars	Dollars	Acres	Acres	Acres	Dollars	Dollars
Lewiston Orchards [3]										3,504	2,715	2,715	561,655	206.87
Minidoka:														
American Falls reservoir district No. 2										98,462	90,744	90,744	6,679,495	73.61
Burley irrigation district										47,937	44,511	44,511	4,693,199	105.44
Fremont-Madison irrigation district										112,000	103,608	103,608	6,865,263	66.26
Minidoka irrigation district										71,882	62,212	62,212	6,059,097	97.39
Leased and water rental lands						4,893	4,893	596,152	121.84		4,893	4,893	596,152	121.84
Warren Act contractors	727,940	704,272	704,272	61,387,600	87.16					727,940	704,272	704,272	61,387,600	87.16
Total—Minidoka project	727,940	704,272	704,272	61,387,600	87.16	4,893	4,893	596,152	121.84	1,058,221	1,010,240	1,010,240	86,280,806	85.41
Rathdrum Prairie:														
Hayden Lake unit [3]										1,087	510	557	42,157	75.69
Post Falls unit [3] [4]										3,109	2,417	2,699	188,253	69.75
Total—Rathdrum Prairie project										4,196	2,927	3,256	230,410	70.76
Idaho-Oregon														
Boise:														
Big Bend irrigation district (Oregon)										1,721	1,487	1,487	107,457	72.26
Black Canyon irrigation district—Unit 1										6,880	6,602	6,602	1,045,685	158.39
Black Canyon irrigation district—Unit 2										51,760	41,009	41,009	2,596,720	63.32
Boise-Kuna irrigation district										48,544	45,529	45,529	4,322,382	94.94
Nampa and Meridian irrigation district										40,262	34,551	34,551	3,291,649	95.27

See footnotes at end of table.

TABLE 7.—Projects in operation—Irrigation and crop value data for the calendar year 1951—Continued

State, project, and subdivision	Special and Warren Act contractors receiving water from Bureau-constructed works					Leased and water rental lands receiving water from Bureau-constructed works				Entire area receiving full or supplemental water from Bureau-constructed works				
	Irrigable area [1]	Irrigated area	Net area in cultivation	Crop values		Irrigated area	Net area in cultivation	Crop values		Irrigable area [1]	Irrigated area	Net area in cultivation	Crop values	
				Total	Per acre			Total	Per acre				Total	Per acre
REGION 1—continued	*Acres*	*Acres*	*Acres*	*Dollars*	*Dollars*	*Acres*	*Acres*	*Dollars*	*Dollars*	*Acres*	*Acres*	*Acres*	*Dollars*	*Dollars*
Idaho-Oregon—Continued														
Boise—Continued														
New York irrigation district										17, 826	14, 573	14, 573	819, 930	56. 26
Settlers irrigation district										518				
Wilder irrigation district										56, 490	50, 399	50, 399	7, 497, 945	148. 77
Warren Act contractors	132, 197	123, 375	123, 375	12, 997, 345	105. 35					132, 197	123, 375	123, 375	12, 997, 345	105. 35
Total—Boise project	132, 197	123, 375	123, 375	12, 997, 345	105. 35					356, 198	317, 525	317, 525	32, 679, 113	102. 92
Montana														
Bitter Root [3]										16, 665	16, 309	16, 309	570, 991	35. 01
Frenchtown										4, 935	3, 027	3, 027	174, 954	57. 80
Missoula Valley [4]										977	440	492	13, 335	27. 10
Oregon														
Arnold [3]										4, 315	2, 988	3, 267	226, 055	69. 19
Baker										7, 312	7, 305	7, 305	299, 230	40. 96
Burnt River										15, 291	15, 240	15, 240	650, 840	42. 71
Deschutes:														
Central Oregon irrigation district										46, 713	43, 082	43, 082	5, 149, 805	119. 53
Lone Pine irrigation district	2, 520									2, 520				
North unit										50, 000	47, 009	47, 582	7, 937, 791	166. 82
Total—Deschutes project	2, 520									99, 233	90, 091	90, 664	13, 087, 596	144. 35
Grants Pass										10, 350	7, 414	7, 544	884, 341	117. 22
Ochoco	8, 500	7, 940	7, 940	923, 653	116. 33					8, 500	7, 940	7, 940	923, 653	116. 33

Umatilla:													
East division										10,911	6,793	6,793	402,489	59.25
West division						899	910	86,272	94.80	7,223	5,807	6,183	308,175	49.84
South division:														
Stanfield irrigation district [3]										6,000	5,168	5,229	555,571	106.25
Westland irrigation district										8,352	5,111	5,111	266,681	52.18
Total—Umatilla project						899	910	86,272	94.80	32,486	22,879	23,316	1,532,916	65.75
Vale										32,000	30,910	30,910	2,627,064	84.99
Oregon-Idaho														
Owyhee:														
Advancement irrigation district										700	628	628	82,636	131.59
Bench irrigation district										2,319	2,222	2,222	578,307	260.26
Crystal irrigation district										1,280	1,129	1,129	265,190	234.89
Gem irrigation district (Idaho)										33,342	31,075	31,075	3,462,434	111.42
Ontario-Nyssa irrigation district										5,831	5,707	5,707	965,380	169.16
Owyhee irrigation district										55,826	52,476	52,476	5,386,316	102.64
Payette-Oregon Slope irrigation district										4,684	4,367	4,367	1,084,190	248.27
Slide irrigation district										1,144	1,089	1,089	131,049	120.34
Warren Act contractors	13,800	13,110	13,110	2,701,361	206.05					13,800	13,110	13,110	2,701,361	206.05
Total—Owyhee project	13,800	13,110	13,110	2,701,361	206.05					118,926	111,803	111,803	14,656,863	131.10
Washington														
Columbia Basin:														
East Columbia Basin irrigation district										80	77	77	24,035	312.14
Quincy-Columbia Basin irrigation district										211	174	174	16,332	93.86
South Columbia Basin irrigation district						226	226	31,409	138.98	6,624	5,310	5,310	729,866	137.45
Total—Columbia Basin project						226	226	31,409	138.98	6,915	5,561	5,561	770,233	138.51

See footnotes at end of table.

TABLE 7.—Projects in operation—Irrigation and crop value data for the calendar year 1951—Continued

State, project, and Subdivision	Special and Warren Act contractors receiving water from Bureau-constructed works					Leased and water rental lands receiving water from Bureau-constructed works				Entire area receiving full or supplemental water from Bureau-constructed works				
	Irrigable area [1]	Irrigated area	Net area in cultivation	Crop values		Irrigated area	Net area in cultivation	Crop values		Irrigable area [1]	Irrigated area	Net area in cultivation	Crop values	
				Total	Per acre			Total	Per acre				Total	Per acre
	Acres	*Acres*	*Acres*	*Dollars*	*Dollars*	*Acres*	*Acres*	*Dollars*	*Dollars*	*Acres*	*Acres*	*Acres*	*Dollars*	*Dollars*
REGION 1—continued														
Washington—Continued														
Okanogan										5, 342	3, 514	3, 514	1, 127, 133	320. 75
Yakima:														
Kittitas division										59, 610	54, 501	54, 501	3, 171, 670	58. 19
Roza division										72, 185	57, 818	57, 818	12, 163, 656	210. 38
Sunnyside division						234	234	64, 229	274. 48	103, 579	80, 176	81, 593	13, 513, 476	165. 31
Tieton division										27, 271	24, 523	24, 736	12, 926, 752	522. 59
Warren Act contractors	190, 841	162, 819	162, 819	32, 173, 678	197. 60					190, 841	162, 819	162, 819	32, 173, 678	197. 60
Total—Yakima project	190, 841	162, 819	162, 819	32, 173, 678	197. 60	234	234	64, 229	274. 48	453, 486	379, 837	381, 467	73, 949, 232	193. 85
Total—Region 1	1, 075, 798	1, 011, 516	1, 011, 516	110, 183, 637	108. 93	6, 252	6, 263	778, 062	124. 23	2, 238, 852	2, 038, 665	2, 042, 095	231, 246, 420	113. 24
REGION 2														
California														
Central Valley [5]	726, 609	523, 889	546, 928	144, 729, 484	264. 62					726, 609	523, 889	546, 928	144, 729, 484	264. 62
Orland										19, 375	17, 130	17, 130	1, 821, 803	106. 35
Oregon-California														
Klamath:														
Main division (Oregon)										41, 082	35, 052	35, 052	4, 854, 297	138. 49
Tule Lake division (California)										44, 287	42, 557	42, 820	8, 112, 654	189. 46
Leased and water rental lands						30, 843	30, 843	4, 829, 733	156. 59		30, 843	30, 843	4, 829, 733	156. 59
Warren Act contractors	87, 286	81, 460	81, 460	8, 314, 246	102. 07					87, 286	81, 460	81, 460	8, 314, 246	102. 07
Total—Klamath project	87, 286	81, 460	81, 460	8, 314, 246	102. 07	30, 843	30, 843	4, 829, 733	156. 59	172, 655	189, 912	190, 175	26, 110, 930	137. 30
Total—Region 2	813, 895	605, 349	628, 388	153, 043, 730	243. 55	30, 843	30, 843	4, 829, 733	156. 59	918, 639	730, 931	754, 233	172, 662, 217	228. 92

REGION 3														
Arizona														
Gila: Yuma Mesa division:														
North Gila unit	764	764	764	88,018	115.21					8,051	6,988	6,988	1,509,005	215.94
South Gila unit	846	846	846	123,888	146.44					846	846	846	123,888	146.44
Yuma Mesa unit										20,251	8,177	8,177	1,285,255	157.18
Total—Gila project	1,610	1,610	1,610	211,906	131.62					29,148	16,011	16,011	2,918,148	182.26
Salt River	95,499	82,788	82,788	24,580,411	296.91					334,406	296,609	307,045	89,509,238	291.52
Arizona-California														
Yuma:														
Reservation division:														
Indian lands (Calif.)										7,743	3,383	3,383	689,861	203.92
Bard irrigation district (California)										7,048	5,922	5,922	983,168	166.02
Valley division (Arizona)										52,991	46,128	46,128	13,170,691	285.52
Yuma Auxiliary (unit B) (Arizona)										3,377	2,144	2,144	694,056	323.72
Total—Yuma project										71,159	57,577	57,577	15,537,776	269.86
California														
All-American Canal:														
Coachella division										60,715	33,489	33,489	18,777,683	560.71
Imperial division [6]	517,000	425,000	440,000	75,249,859	171.02					517,000	425,000	440,000	75,249,859	171.02
Total—Region 3	614,109	509,398	524,398	100,042,176	190.78					1,012,428	828,686	854,122	201.992.704	236.49
REGION 4														
Colorado														
Fruitgrowers Dam [3]										2,662	2,099	2,099	280,237	133.51
Paonia [3]										11,500	10,063	10,063	1,012,007	100.57
Grand Valley:														
Garfield Gravity division						75	75	12,689	169.19	30,444	21,372	21,372	1,917,279	89.71
Orchard Mesa division [3]										10,027	8,138	8,138	1,829,192	224.77
Warren Act contractors	8,045	7,685	7,685	1,039,415	135.25					8,045	7,685	7,685	1,039,415	135.25
Total—Grand Valley project	8,045	7,685	7,685	1,039,415	135.25	75	75	12,689	169.19	48,516	37,195	37,195	4,785,886	128.67

See footnotes at end of table.

TABLE 7.—Projects in operation—Irrigation and crop value data for the calendar year 1951—Continued

State, project, and subdivision	Special and Warren Act contractors receiving water from Bureau-constructed works					Leased and water rental lands receiving water from Bureau-constructed works				Entire area receiving full or supplemental water from Bureau-constructed works				
	Irrigable area [1]	Irrigated area	Net area in cultivation	Crop values		Irrigated area	Net area in cultivation	Crop values		Irrigable area [1]	Irrigated area	Net area in cultivation	Crop values	
				Total	Per acre			Total	Per acre				Total	Per acre
	Acres	*Acres*	*Acres*	*Dollars*	*Dollars*	*Acres*	*Acres*	*Dollars*	*Dollars*	*Acres*	*Acres*	*Acres*	*Dollars*	*Dollars*
REGION 4—Continued														
Colorado—Continued														
Mancos [4]										8,592	7,363	7,389	367,060	49.68
Pine River						28	28	140	5.00	35,812	33,927	33,927	1,143,805	33.71
Pine River Indian irrigation										9,493	9,273	9,273	333,757	35.99
Uncompahgre	17,112	16,858	16,858	760,264	45.10					89,081	74,207	74,207	6,076,028	81.88
Idaho														
Preston Bench [3]										6,660	4,744	4,744	388,840	81.96
Nevada														
Humboldt										40,012	25,438	25,438	1,811,494	71.21
Newlands:														
North Carson division										7,153	4,094	4,117	307,564	74.71
South Carson division										57,805	44,608	45,121	1,870,704	41.46
Truckee division										7,178	4,649	4,668	293,662	62.91
Total—Newlands project										72,136	53,351	53,906	2,471,930	45.86
Truckee Storage										28,793	24,296	24,296	2,232,740	91.90
Utah														
Hyrum										6,475	5,674	5,674	385,629	67.96
Moon Lake										75,233	58,380	58,729	1,544,064	26.29
Newton [4]										2,552	1,962	1,962	142,971	72.87
Ogden River										22,861	15,946	15,964	2,060,767	129.09
Provo River: Deer Creek division										46,609	39,577	40,680	4,605,399	113.21
Sanpete:														
Ephraim division										7,630	6,448	7,133	246,198	34.52
Spring City division										6,023	4,926	5,778	172,438	29.84
Total—Sanpete project										13,653	11,374	12,911	418,636	32.42

Scofield [4]										14,754	14,090	14,154	991,570	70.06
Strawberry Valley:														
High Line division										17,745	15,942	15,942	919,572	57.68
Spanish Fork division	3,987	3,864	3,864	327,426	84.74					17,742	17,153	17,153	1,501,996	87.56
Springville-Mapleton division										8,569	8,031	8,031	629,108	78.33
Total—Strawberry Valley project	3,987	3,864	3,864	327,426	84.74					44,056	41,126	41,126	3,050,676	74.18
Weber River										108,817	90,762	90,817	11,786,522	129.78
Total—Region 4	29,144	28,407	28,407	2,127,105	74.88	103	103	12,829	124.55	688,267	560,847	564,554	45,890,018	81.29
REGION 5														
Oklahoma														
W. C. Austin										47,810	46,322	46,322	5,160,452	111.40
New Mexico														
Carlsbad										25,055	24,717	24,717	4,451,096	180.08
Fort Sumner [3]										6,500	5,188	5,188	485,959	93.67
Tucumcari										42,214	33,318	33,318	1,978,029	59.37
New Mexico–Texas														
Rio Grande:														
Elephant Butte irrigation dist. (New Mexico)										88,000	90,608	90,629	24,548,706	270.87
El Paso County water improvement district No. 1 (Texas)						158	158	53,796	340.48	67,000	66,324	66,324	21,347,580	321.87
Hudspeth County conservation and reclamation district No. 1	20,000	17,752	17,752	4,149,089	233.73					20,000	17,752	17,752	4,149,089	233.73
Total—Rio Grande project [7]	20,000	17,752	17,752	4,149,089	233.73	158	158	53,796	340.48	175,000	174,684	174,705	50,045,375	286.46
Texas														
Balmorhea [4]										10,191	8,086	8,086	1,168,935	144.56
Total—Region 5	20,000	17,752	17,752	4,149,089	233.73	158	158	53,796	340.48	306,770	292,315	292,336	63,289,846	216.50

See footnotes at end of table.

TABLE 7.—Projects in operation—Irrigation and crop value data for the calendar year 1951—Continued

State, project, and subdivision	Special and Warren Act contractors receiving water from Bureau-constructed works					Leased and water rental lands receiving water from Bureau-constructed works				Entire area receiving full or supplemental water from Bureau-constructed works				
	Irrigable area [1]	Irrigated area	Net area in cultivation	Crop values		Irrigated area	Net area in cultivation	Crop values		Irrigable area [1]	Irrigated area	Net area in cultivation	Crop values	
				Total	Per acre			Total	Per acre				Total	Per acre
REGION 6														
Montana														
Buffalo Rapids:	*Acres*	*Acres*	*Acres*	*Dollars*	*Dollars*	*Acres*	*Acres*	*Dollars*	*Dollars*	*Acres*	*Acres*	*Acres*	*Dollars*	*Dollars*
First division [4]										13, 916	13, 344	13, 344	822, 949	61. 67
Second division [4]										8, 608	8, 351	8, 351	387, 671	46. 42
Leased and water rental lands						1, 928	1, 928	64, 187	33. 29		1, 928	1, 928	64, 187	33. 29
Total—Buffalo Rapids project						1, 928	1, 928	64, 187	33. 29	22, 524	23, 623	23, 623	1, 274, 807	53. 96
Huntley						734	734	52, 539	71. 58	32, 508	25, 577	25, 577	1, 399, 426	54. 71
Intake [4]										881	473	473	25, 294	53. 48
Milk River:														
Chinook division										43, 484	27, 710	28, 138	1, 482, 121	52. 67
Dodson Pumping unit [4]										1, 180	1, 180	1, 180	47, 062	39. 88
Glasgow division										19, 407	11, 679	11, 897	404, 267	33. 98
Malta division										53, 733	27, 129	27, 460	872, 409	31. 77
Pump lands										6, 237	6, 105	6, 237	368, 612	59. 10
Total—Milk River project										124, 041	73, 803	74, 912	3, 174, 471	42. 38
Missouri River Basin project: Yellowstone division—Savage unit										2, 216	1, 940	1, 940	62, 720	32. 33
Sun River:														
Fort Shaw division										13, 902	8, 159	8, 534	248, 591	29. 13
Greenfields division										83, 373	68, 497	77, 276	2, 197, 184	28. 43
Total—Sun River project										97, 275	76, 656	85, 810	2, 445, 775	28. 50

Montana-North Dakota														
Lower Yellowstone:														
District No. 1 (Montana)										37, 272	32, 972	33, 015	1, 864, 442	56. 47
District No. 2 (North Dakota)										19, 928	16, 573	16, 589	930, 011	56. 06
Leased and water rental lands						715	715	19, 943	27. 89		715	715	19, 943	27. 89
Total—Lower Yellowstone project						715	715	19, 943	27. 89	57, 200	50, 260	50, 319	2, 814, 396	55. 93
North Dakota														
Buford-Trenton [4]										8, 199	8, 003	8, 003	395, 489	49. 42
South Dakota														
Belle Fourche										59, 129	54, 137	54, 163	2, 328, 136	42. 98
Rapid Valley [4]										8, 900	7, 101	7, 101	226, 973	31. 96
Wyoming														
Riverton:														
Midvale irrigation district										48, 628	42, 763	42, 763	1, 928, 112	45. 09
Third division										12, 671	9, 263	9, 263	294, 682	31 81
Warren Act contractors	1, 945	1, 871	1, 871	80, 628	43. 09					1, 945	1, 871	1, 871	80, 628	43. 09
Total—Riverton project	1, 945	1, 871	1, 871	80, 628	43. 09					63, 244	53, 897	53, 897	2, 303, 422	42. 74
Wyoming-Montana														
Shoshone:														
Frannie division										20, 083	10, 282	10, 282	348, 702	33. 91
Garland division										41, 627	34, 176	34, 176	1, 572, 968	46. 03
Heart Mountain division										25, 182	21, 407	21, 407	1, 086, 717	50. 76
Willwood division										11, 426	10, 155	10, 155	481, 453	47. 41
Leased and water rental lands						696	696	19, 844	28. 51		696	696	19, 844	28. 51
Total—Shoshone project						696	696	19, 844	28. 51	98, 318	76, 716	76, 716	3, 509, 684	45. 75
Total—Region 6	1, 945	1, 871	1, 871	80, 628	43. 09	4, 073	4, 073	156, 513	38. 43	574, 435	452, 186	462, 534	19, 960, 593	43. 15

See footnotes at end of table.

TABLE 7.—Projects in operation—Irrigation and crop value data for the calendar year 1951—Continued

State, project, and subdivision	Special and Warren Act contractors receiving water from Bureau-constructed works					Leased and water rental lands receiving water from Bureau-constructed works				Entire area receiving full or supplemental water from Bureau-constructed works				
	Irrigable area [1]	Irrigated area	Net area in cultivation	Crop values		Irrigated area	Net area in cultivation	Crop values		Irrigable area [1]	Irrigated area	Net area in cultivation	Crop values	
				Total	Per acre			Total	Per acre				Total	Per acre
REGION 7														
Colorado	*Acres*	*Acres*	*Acres*	*Dollars*	*Dollars*	*Acres*	*Acres*	*Dollars*	*Dollars*	*Acres*	*Acres*	*Acres*	*Dollars*	*Dollars*
Colorado-Big Thompson										615,000	615,000	615,000	63,300,517	102.93
Nebraska														
Mirage Flats [4]										11,659	11,331	11,331	688,077	60.73
Nebraska–Wyoming														
North Platte:														
Gering–Fort Laramie irrigation district										51,845	52,780	52,780	4,772,925	90.43
Goshen irrigation district (Wyoming)										52,481	48,038	48,038	3,746,764	78.00
Northport irrigation district										13,615	13,518	13,518	409,266	30.28
Pathfinder irrigation district										102,824	87,535	87,535	4,357,821	49.78
Leased and water rental lands						29,214	29,214	2,369,621	81.11		29,214	29,214	2,369,621	81.11
Warren Act contractors	108,715	105,382	105,382	6,688,109	63.47					108,715	105,382	105,382	6,688,109	63.47
Total—North Platte project	108,715	105,382	105,382	6,688,109	63.47	29,214	29,214	2,369,621	81.11	332,483	336,467	336,467	22,344,503	66.41
Wyoming														
Kendrick										14,482	9,341	9,341	346,767	37.12
Total—Region 7	108,715	105,382	105,382	6,688,109	63.47	29,214	29,214	2,369,621	81.11	973,624	972,139	972,139	86,679,867	89.16

SUMMARY

	Irrigable area [1]	Irrigated area	Net area in cultivation	Total crop value	Value per acre
	Acres	*Acres*	*Acres*	*Dollars*	*Dollars*
Regular projects	2, 782, 007	2, 360, 471	2, 345, 125	325, 819, 528	138. 93
Supplemental projects	1, 267, 402	1, 164, 980	1, 168, 602	108, 087, 562	92. 49
Special and Warren Act contractors	2, 663, 606	2, 279, 675	2, 317, 714	376, 314, 474	162. 36
Additional areas reported:					
Temporarily suspended land			39, 918	3, 299, 547	82. 66
Leased and water rental lands		70, 643	70, 654	8, 200, 554	116. 07
Grand total	6, 713, 015	5, 875, 769	5, 942, 013	821, 721, 665	138. 29
Grand total, 1950	6, 024, 510	5, 077, 186	5, 189, 463	578, 237, 709	111. 43
Increase, 1950–51 total	688, 505	798, 583	752, 550	243, 483, 956	26. 86

[1] Area for which the Bureau is prepared to supply water.

[2] Generally part of irrigable area but not subject to construction charges until reclaimed.

[3] Private project reconstructed with Government funds.

[4] Water conservation and utilization project.

[5] Special contract.

[6] Special contract. Bureau constructed diversion dam and canal carriage system. Distribution system and power plants on the All-American Canal were built by Imperial irrigation district. Prior to construction of All-American Canal, district lands were irrigated with Colorado River water from a district-constructed system.

[7] Although there are 178,003 acres that can be irrigated within project limits, the area for which there is considered to be a safe and reliable water supply is 155,000 acres.

Note: Per acre value based on net area in cultivation.

TABLE 8.—Cumulative crop values, 1906–51

Year	Federal irrigation projects [1]					Warren Act lands and special contractors					Entire area				
	Irrigable acreage	Irrigated acreage	Net area in cultivation	Total crop value		Irrigable acreage	Irrigated acreage	Net area in cultivation	Total crop value		Irrigable acreage	Irrigated acreage	Net area in cultivation	Total crop value	
				For year	Cumulative total				For year	Cumulative total				For year	Cumulative total
1906	39, 300	[2] 22, 300	[2] 20, 100	[2] $244, 900							39, 300	[2] 22, 300	[2] 20, 100	[2] $244, 900	
1907	266, 300	[2] 187, 628	[2] 169, 000	[2] 4, 760, 460	$5, 005, 360						266, 300	[2] 187, 628	[2] 169, 000	[2] 4, 760, 460	$5, 005, 360
1908	488, 942	[3] 289, 549	[2] 260, 500	[2] 7, 635, 888	12, 641, 248						488, 942	[2] 289, 549	[2] 260, 500	[2] 7, 635, 888	12, 641, 248
1909	730, 601	410, 628	410, 628	11, 920, 663	24, 561, 911						730, 601	410, 628	369, 500	11, 920, 663	24, 561, 911
1910	917, 751	473, 423	473, 423	12, 974, 639	37, 536, 550						917, 751	473, 423	413, 000	12, 974, 639	37, 536, 550
1911	1, 042, 609	564, 681	564, 681	13, 121, 224	50, 657, 774						1, 042, 609	564, 681	470, 100	13, 121, 224	50, 657, 774
1912	1, 205, 236	618, 680	641, 397	14, 479, 368	65, 137, 142						1, 205, 236	618, 680	540, 000	14, 479, 368	65, 137, 142
1913	1, 255, 381	699, 183	642, 216	15, 732, 215	80, 869, 357						1, 255, 381	699, 183	637, 227	15, 732, 215	80, 869, 357
1914	1, 240, 875	761, 271	703, 424	16, 475, 517	97, 344, 874						1, 240, 875	761, 271	703, 424	16, 475, 517	97, 344, 874
1915	1, 472, 772	856, 778	757, 613	18, 164, 452	115, 509, 326						1, 472, 772	856, 778	760, 035	18, 164, 452	115, 509, 326
1916	1, 405, 452	922, 821	858, 291	32, 815, 972	148, 325, 298						1, 405, 452	922, 821	858, 291	32, 815, 972	148, 325, 298
1917	1, 599, 525	1, 057, 513	966, 784	56, 462, 313	204, 787, 611						1, 599, 525	1, 057, 513	966, 784	56, 462, 313	204, 787, 611
1918	1, 732, 374	1, 141, 516	1, 051, 193	66, 821, 396	271, 609, 007	951, 987	[2] 501, 100	[2] 481, 600	[2] $35, 000, 000		2, 684, 361	[2] 1, 642, 616	[2] 1, 532, 793	[2] 101, 821, 396	306, 609, 007
1919	1, 636, 159	1, 187, 255	1, 113, 469	88, 974, 137	360, 583, 144	1, 011, 815	916, 313	880, 613	64, 004, 750	$99, 004, 750	2, 647, 974	2, 103, 568	1, 994, 082	152, 978, 887	459, 587, 894
1920	1, 661, 960	1, 223, 480	1, 153, 820	66, 171, 650	426, 754, 794	1, 183, 292	981, 940	950, 890	47, 505, 770	146, 510, 520	2, 845, 252	2, 205, 420	2, 104, 710	113, 677, 420	573, 265, 314
1921	1, 674, 100	1, 227, 500	1, 157, 900	49, 620, 300	476, 375, 094	1, 146, 810	1, 001, 250	969, 550	44, 906, 130	191, 416, 650	2, 820, 910	2, 228, 750	2, 127, 450	94, 526, 430	667, 791, 744
1922	1, 692, 700	1, 202, 130	1, 169, 100	50, 360, 850	526, 735, 944	1, 101, 700	983, 290	951, 270	33, 240, 840	224, 657, 490	2, 794, 400	2, 185, 420	2, 120, 370	83, 601, 690	751, 393, 434
1923	1, 718, 400	1, 213, 700	1, 179, 870	65, 046, 300	591, 782, 244	1, 231, 400	1, 051, 380	993, 040	37, 557, 860	262, 215, 350	2, 949, 800	2, 265, 080	2, 172, 910	102, 604, 160	853, 997, 594
1924	1, 805, 730	1, 290, 890	1, 216, 610	66, 488, 560	658, 270, 804	1, 237, 885	930, 670	889, 460	43, 237, 470	305, 452, 820	3, 043, 615	2, 221, 560	2, 106, 070	109, 726, 030	963, 723, 624
1925	1, 802, 970	1, 320, 300	1, 242, 750	77, 608, 880	735, 879, 684	1, 340, 000	1, 019, 170	951, 250	53, 655, 850	359, 108, 670	3, 142, 970	2, 339, 470	2, 194, 000	131, 264, 730	1, 094, 988, 354
1926	1, 844, 550	1, 411, 020	1, 361, 470	60, 664, 900	796, 544, 584	1, 329, 020	1, 097, 190	949, 590	49, 750, 040	408, 858, 710	3, 173, 570	2, 508, 210	2, 278, 400	110, 414, 940	1, 205, 403, 294
1927	1, 956, 910	1, 378, 990	1, 431, 560	72, 047, 200	868, 591, 784	1, 482, 950	1, 148, 115	1, 072, 486	61, 160, 010	470, 018, 720	3, 439, 860	2, 527, 105	2, 399, 296	133, 207, 210	1, 338, 610, 504
1928	1, 882, 930	1, 442, 080	1, 489, 240	81, 077, 750	949, 669, 534	1, 490, 735	1, 235, 020	1, 192, 030	62, 495, 320	532, 514, 040	3, 373, 665	2, 677, 100	2, 577, 590	143, 573, 070	1, 482, 183, 574
1929	1, 922, 330	1, 483, 900	1, 512, 250	88, 459, 390	1, 038, 128, 924	1, 480, 040	1, 234, 230	1, 192, 990	72, 720, 490	605, 234, 530	3, 402, 370	2, 718, 130	2, 613, 060	161, 179, 880	1, 643, 363, 454
1930	1, 993, 390	1, 504, 810	1, 550, 967	65, 007, 270	1, 103, 136, 194	1, 640, 722	1, 286, 046	1, 254, 493	54, 654, 550	659, 889, 080	3, 634, 112	2, 790, 856	2, 721, 590	119, 661, 820	1, 763, 025, 274
1931	2, 027, 264	1, 552, 718	1, 520, 354	40, 554, 037	1, 143, 690, 231	1, 588, 972	1, 293, 889	1, 251, 830	33, 406, 340	693, 295, 420	3, 616, 236	2, 846, 607	2, 714, 395	73, 960, 377	1, 836, 985, 651
1932	2, 039, 074	1, 555, 144	1, 578, 880	31, 531, 162	1, 175, 221, 393	1, 512, 405	1, 214, 461	1, 196, 400	18, 627, 219	711, 922, 639	3, 551, 479	2, 769, 605	2, 702, 720	50, 158, 381	1, 887, 144, 032
1933	2, 025, 508	1, 589, 770	1, 598, 702	48, 765, 863	1, 223, 987, 256	1, 514, 201	1, 239, 017	1, 199, 113	35, 425, 870	747, 348, 509	3, 539, 709	2, 828, 787	2, 797, 815	84, 191, 733	1, 971, 335, 765
1934	1, 986, 268	1, 552, 124	1, 527, 104	60, 928, 969	1, 284, 916, 225	1, 508, 377	1, 285, 081	1, 229, 594	40, 014, 745	787, 363, 254	3, 494, 645	2, 837, 205	2, 693, 999	100, 943, 714	2, 072, 279, 479
1935	2, 113, 506	1, 640, 936	1, 604, 166	63, 601, 663	1, 348, 517, 888	1, 500, 589	1, 294, 680	1, 256, 970	43, 179, 631	830, 542, 885	3, 614, 095	2, 935, 616	2, 861, 136	106, 781, 294	2, 179, 060, 773
1936	2, 166, 409	1, 702, 192	1, 629, 174	78, 902, 818	1, 427, 420, 706	1, 527, 008	1, 335, 995	1, 272, 745	57, 599, 662	888, 142, 547	3, 693, 417	3, 038, 187	2, 901, 919	136, 502, 480	2, 315, 563, 253
1937	2, 194, 830	1, 725, 463	1, 700, 969	72, 893, 649	1, 500, 314, 355	1, 571, 382	1, 389, 338	1, 333, 800	45, 764, 623	933, 907, 170	3, 766, 212	3, 114, 801	3, 034, 769	118, 658, 272	2, 434, 221, 525
1938	2, 275, 882	1, 777, 584	1, 764, 363	67, 859, 804	1, 568, 174, 159	1, 507, 051	1, 329, 115	1, 276, 332	45, 603, 656	979, 510, 826	3, 782, 933	3, 106, 699	3, 040, 695	113, 463, 460	2, 547, 684, 985
1939	2, 492, 740	1, 922, 868	1, 903, 269	73, 769, 654	1, 641, 943, 813	1, 396, 800	1, 218, 108	1, 174, 803	40, 313, 140	1, 019, 823, 966	3, 889, 540	3, 140, 976	3, 078, 072	114, 082, 794	2, 661, 767, 779
1940	2, 780, 811	2, 152, 808	2, 138, 927	80, 098, 196	1, 722, 042, 009	1, 399, 057	1, 238, 262	1, 177, 103	37, 690, 481	1, 057, 514, 447	4, 179, 868	3, 391, 070	3, 316, 030	117, 788, 677	2, 779, 556, 456
1941	3, 547, 816	2, 199, 179	2, 178, 288	110, 399, 807	1, 832, 441, 816	1, 398, 338	1, 249, 204	1, 202, 172	49, 486, 191	1, 107, 000, 638	4, 946, 154	3, 448, 383	3, 380, 460	159, 885, 998	2, 939, 442, 454
1942	3, 487, 944	2, 688, 723	2, 615, 048	193, 783, 707	2, 026, 225, 523	1, 360, 757	1, 247, 512	1, 206, 651	78, 264, 809	1, 185, 265, 447	4, 848, 701	3, 936, 235	3, 821, 699	272, 048, 516	3, 211, 490, 970
1943	2, 957, 806	2, 422, 288	2, 398, 922	218, 064, 208	2, 244, 289, 731	1, 896, 026	1, 633, 041	1, 615, 424	170, 606, 761	1, 355, 872, 208	4, 853, 832	4, 055, 329	4, 014, 346	388, 670, 969	3, 600, 161, 939

1944	2, 970, 714	2, 468, 842	2, 475, 280	224, 683, 280	2, 468, 973, 011	1, 969, 281	1, 694, 861	1, 664, 069	186, 543, 084	1, 542, 415, 292	4, 939, 995	4, 163, 703	4, 139, 349	411, 226, 364	4, 011, 388, 303
1945	2, 975, 590	2, 416, 961	2, 464, 672	232, 545, 321	2, 701, 518, 332	2, 054, 746	1, 745, 627	1, 731, 060	202, 639, 074	1, 745, 054, 366	5, 030, 336	4, 162, 588	4, 195, 732	435, 184, 395	4, 446, 572, 698
1946	3, 079, 761	2, 513, 687	2, 567, 050	279, 711, 300	2, 981, 229, 632	2, 071, 070	1, 808, 282	1, 829, 531	250, 912, 645	1, 995, 967, 011	5, 150, 831	4, 321, 969	4, 396, 581	530, 623, 945	4, 977, 196, 643
1947	3, 091, 977	2, 629, 727	2, 683, 253	300, 474. 560	3, 281, 704, 192	2, 074, 806	1, 831, 975	1, 871, 099	254, 946, 244	2, 250, 913, 255	5, 166, 783	4, 461, 702	4, 554, 352	555, 420, 804	5, 532, 617, 447
1948	3, 221, 464	2, 664, 619	2, 760, 493	277, 160, 874	3, 558, 865, 066	2, 158, 551	1, 894, 136	1, 939, 241	257, 462, 667	2, 508, 375, 922	5, 380, 015	4, 558, 755	4, 699, 734	534, 623, 541	6, 067, 240, 988
1949	3, 296, 297	2, 792, 108	2, 848, 896	277, 347, 763	3, 836, 212, 829	2, 382, 215	2, 028, 481	2, 067, 338	238, 981, 245	2, 747, 357, 167	5, 678, 512	4, 820, 589	4, 916, 234	516, 329, 008	6, 583, 569, 996
1950	3, 398, 168	2, 857, 533	2, 918, 105	287, 683, 368	4, 123, 896, 197	2, 626, 342	2, 219, 653	2, 271, 358	290, 554, 341	3, 037, 911, 508	6, 024, 510	5, 077, 186	5, 189, 463	578, 237, 709	7, 161, 807, 705
1951	4, 049, 409	3, 596, 094	3, 624, 299	445, 407, 191	4, 569, 303, 388	2, 663, 606	2, 279, 675	2, 317, 714	376, 314, 474	3, 414, 225, 982	6, 713, 015	5, 875, 769	5, 942, 013	821, 721, 665	7, 983, 529, 370

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[1] Includes projects constructed by the United States and those for which supplemental water is furnished from storage works built by the United States.

[2] Estimated.

POWER UTILIZATION

Installation and production of hydroelectric power capacity took great strides on the multipurpose projects of the Bureau of Reclamation during fiscal year 1952.

By June 30, 1952, the total installed capacity in power plants constructed and operated by the Bureau of Reclamation was 4,181,200 kilowatts. This increase of 241,700 kilowatts, together with the existing facilities, served market areas in the western United States with much-needed electric energy for industrial and domestic purposes. The sales of electric energy during the fiscal year totaled 25,332,204,310 kilowatt-hours, which brought in revenues of $43,310,035 to the Treasury. During fiscal year 1953, the Bureau is scheduled to increase power production capacity 342,950 kilowatts. A summary of fiscal year 1952 power sales and revenues by projects is shown in table 9.

TABLE 9.—Bureau of Reclamation power systems, power sales, and revenues by projects, fiscal year ending June 30, 1952

Region and project	Sales of electric energy, kilowatt-hours	Revenue from sales
Region 1:		
Boise project	189, 322, 683	$412, 921. 04
Columbia Basin project	14, 080, 546, 400	11, 100, 000. 00
Minidoka project	117, 026, 898	520, 209. 87
Yakima project	23, 819, 488	61, 879. 65
Total	14, 410, 715, 469	12, 095, 010. 56
Region 2: Central Valley project	2, 514. 551, 476	9, 894, 306. 39
Region 3:		
Boulder Canyon project	5, 571, 442, 485	9. 247, 718. 97
Parker-Davis project	1, 693, 941, 806	5, 821, 921. 90
Yuma project	8, 649, 125	42, 622. 49
Total	7, 274, 033, 416	15, 112, 263. 36
Region 5: Rio Grande project	107, 842, 909	712, 311. 26
Region 6:		
Fort Peck project	406, 610, 598	1, 541, 261. 35
Riverton project	29, 927, 394	180, 996. 27
Shoshone project	75. 053, 062	465, 279. 09
Missouri River Basin-Oahe district	3, 720, 000	15, 487. 57
Total	515, 311, 054	2, 203, 024. 28
Region 7:		
Colorado-Big Thompson project	236, 433, 437	1, 361, 653. 39
Kendrick project	181, 133, 877	1, 112, 630. 31
Missouri River Basin—North Platte River district	39, 116, 219	272, 329. 55
North Platte project	53, 066, 453	546, 505. 76
Total	509, 749, 986	3, 293, 119. 01
Grand total	25, 332, 204, 316	[1] 43, 310, 034. 86

[1] Does not include energy sales and revenues in transactions between Bureau projects.

The power output on Reclamation multipurpose projects which included a record-breaking performance by the Grand Coulee power plant on December 31, 1951, of 2,226,000 kilowatts hourly peak demand indicates the great need for power in areas which are served by

Bureau plants. Applications for power service continued to mount and contracts for the sale of energy are being processed to provide for the widespread distribution and integrated use of power to be produced from plants now under construction.

Many applications from industrial and rural areas for blocks of power have been received by the Bureau of Reclamation but many of the demands could not be met because the present power production is fully utilized and a good deal of the future production committed. This has a great bearing on the defense production of the country.

The continuing demand by preferential customers in the rural areas is still a major factor contributing to the increasing power requirements in many areas. These requirements are being met by transmission-line construction where necessary and financially feasible and by wheeling arrangements with other utilities already in the area.

The Bureau of Reclamation is continuing to plan the development of power consistent with multipurpose development of the West's valuable water resources.

Present Installed Capacity

During the fiscal year ending June 30, 1952, the Bureau had 24 power plants with a total nameplate capacity of 4,181,200 kilowatts, an increase of 241,700 kilowatts capacity over the fiscal year 1951 figure. The capacity installed during fiscal year 1952 is as follows:

	Kilowatts
Boulder Canyon project	132,500
Missouri River Basin project	1,200
Grand Coulee project	108,000
Total	241,700

Power plants operated by other agencies, principally water users' organizations, on Reclamation projects totaled 16, of which 9 were originally constructed by the Bureau. These nine plants have an installed capacity of 30,827 kilowatts; the seven other plants constructed by the water users' organizations have an installed capacity of 72,500 kilowatts.

Additional Capacity Under Construction

At the end of fiscal year 1952, the Bureau of Reclamation had under construction 14 new power plants, which will have an ultimate installed nameplate capacity of 842,050 kilowatts.

New projects under construction will include the power facilities of Kenil, Little Porcupine, and Tiber power plants, with a combined capacity of 21,600 kilowatts, in Montana on the Missouri River Basin project; Chandler, with a capacity of 12,000 kilowatts in Washington on the Yakima project; Gateway and Wanship, with a combined capacity of 8,400 kilowatts on the Weber Basin project in Utah. The United States Army Corps of Engineers is proceeding with the construction of its plants on the Missouri River Basin project. The Bureau of Reclamation will be the marketing agent for energy generated by all plants constructed by the Corps on the Missouri River Basin project.

Authorized to be constructed by the Bureau of Reclamation as of June 30, 1952, are 22 power plants, with a total capacity of 869,300 kilowatts.

The status of hydroelectric power plants on Reclamation projects is shown in table 10.

TABLE 10.—Hydroelectric plants on Reclamation projects, operating, under construction, or authorized, as of June 30, 1952

CONSTRUCTED AND OPERATED BY BUREAU OF RECLAMATION

State	Project	Name of plant	Calendar year of initial operation	Nameplate capacity		Number and nameplate capacity of generators	
				Existing (kilowatts)	Ultimate (kilowatts)	Existing (kilowatts)	Ultimate (kilowatts)
Arizona-Nevada	Boulder Canyon	Hoover [1]	1936	1, 167, 300	1, 332, 300	13–82,500; 1–40,000; 2–2,400; 1–50,000.	15–82,500; 1–40,000; 1–50,000; 2–2,400.
Do	Davis Dam	Davis	1951	225, 000	225, 000	5–45,000	5–45,000.
Arizona-California	Parker	Parker	1942	120, 000	120, 000	4–30,000	4–30,000.
California	Central Valley	Keswick	1949	75, 000	75, 000	3–25,000	3–25,000.
Do	do	Shasta	1944	379, 000	379, 000	5–75,000; 2–2,000	5–75,000; 2–2,000.
Do	Yuma	Siphon Drop	1926	1, 600	1, 600	2–800	2–800.
Colorado	Colorado-Big Thompson	Estes	1950	45, 000	45, 000	3–15,000	3–15,000.
Do	do	Green Mountain	1943	21, 600	21, 600	2–10,800	2–10,800.
Do	do	Marys Lake	1951	8, 100	8, 100	1–8,100	1–8,100.
Idaho	Boise	Anderson Ranch	1950	27, 000	[2] 40, 500	2–13,500	3–13,500.[2]
Do	do	Black Canyon	1925	8, 000	8, 000	2–4,000	2–4,000.
Do	do	Boise Diversion	1912	1, 500	1, 500	3–500	3–500.
Do	Minidoka	Minidoka	1909	13, 400	13, 400	1–5,000; 1–2,400; 5–1,200	1–5,000; 1–2,400; 5–1,200.
South Dakota	Missouri River Basin	Angostura	1951	1, 200	1, 200	1–1,200	1–1,200.
New Mexico	Rio Grande	Elephant Butte	1940	24, 300	24, 300	3–8,100	3–8,100.
Washington	Columbia	Grand Coulee [3] [4]	1941	1, 974, 000	1, 974, 000	18–108,000;[4] 3–10,000	18–108,000;[4] 3–10,000.
Do	Yakima	Prosser [5]	1932	2, 400	2, 400	1–2,400	1–2,400.
Wyoming	Kendrick	Seminoe	1939	32, 400	32, 400	3–10,800	3–10,800.
Do	Missouri River Basin	Kortes	1950	36, 000	36, 000	3–12,000	3–12,000.
Do	North Platte and Missouri River Basin.	Guernsey	1927	4, 800	14, 800	2–2,400	2–2,400; 1–10,000.
Do	North Platte	Lingle	1919	1, 400	1, 400	2–400; 2–300	2–400; 2–300.
Do	Riverton	Pilot Butte	1925	1, 600	1, 600	2–800	2–800.
Do	Shoshone	Heart Mountain	1948	5, 000	5, 000	1–5,000	1–5,000.
Do	do	Shoshone	1922	5, 600	5, 600	1–4,000; 2–800	1–4,000; 2–800.
Subtotal				4, 181, 200	4, 369, 700		

CONSTRUCTED BY BUREAU OF RECLAMATION; OPERATED BY OTHERS

State	Project	Name of plant	Calendar year of initial operation	Existing (kilowatts)	Ultimate (kilowatts)	Existing (kilowatts)	Ultimate (kilowatts)
Arizona	Salt River	Arizona Falls [6]	1913	850	850	2–425	2–425.
Do	do	Cross Cut [6]	1914	5, 100	5, 100	1–3,000; 3–700	1–3,000, 3–700.
Do	do	Roosevelt	1909	15, 400	15, 400	5–1,080; 1–4,000; 1–6,000	5–1,080; 1–4,000; 1–6,000.
Do	do	S. Consolidated [6]	1912	1, 600	1, 600	2–800	2–800.
Colorado	Grand Valley	Grand Valley (Palisades)	1932	3, 000	3, 000	2–1,500	2–1,500.
Nevada	Newlands	Lahontan	1911	1, 640	1, 640	1–640; 2–500	1–640; 2–500.
Oregon	Deschutes	Cove [7]	1946	1, 500	1, 500	1–1,500	1–1,500.
Utah	Strawberry Valley	Spanish Fork [8]	1908	1, 550	1, 550	2–450; 1–250; 1–400	2–450; 1–250; 1–400.
Washington	Yakima	Rocky Ford	1916	187	187	1–187	1–187.
Subtotal				30, 827	30, 827		

See footnotes at end of table.

TABLE 10.—Hydroelectric plants on Reclamation projects, operating, under construction, or authorized, as of June 30, 1952—Continued

CONSTRUCTED AND OPERATED BY WATER USERS ORGANIZATIONS

State	Project	Name of plant	Calendar year of initial operation	Nameplate capacity		Number and nameplate capacity of generators	
				Existing (kilowatts)	Ultimate (kilowatts)	Existing (kilowatts)	Ultimate (kilowatts)
Arizona	Salt River	Chandler [9]	1919	600	600	1–600	1–600.
Do	do	Horse Mesa [9]	1927	30,000	30,000	3–10,000	3–10,000.
Do	do	Mormon Flat [9]	1926	7,000	7,000	1–7,000	1–7,000.
Do	do	Stewart Mountain [9]	1930	10,400	10,400	1–10,400	1–10,400.
California	All-American	Drop No. 3 [10]	1941	4,800	9,600	1–4,800	2–4,800.
Do	do	Drop No. 4 [10]	1941	19,200	19,200	2–9,600	2–9,600.
Oregon	Klamath	"C" Canal Drop [11]	1938	500	500	1–500	1–500.
Subtotal				72,500	77,300		
CONSTRUCTED AND OPERATED BY CORPS OF ENGINEERS, DEPARTMENT OF THE ARMY; POWER MARKETED BY BUREAU OF RECLAMATION							
Montana	Fort Peck	Fort Peck	1943	85,000	185,000	2–35,000; 1–15,000	3–35,000; 2–40,000.
UNDER CONSTRUCTION BY BUREAU OF RECLAMATION							
Alaska	Eklutna	Eklutna	1954	0	30,000	0	2–15,000.
California	Central Valley	Folsom	1954	0	162,000	0	3–54,000.
Do	do	Nimbus	1955	0	13,500	0	2–6,750.
Colorado	Colorado-Big Thompson	Flatiron	1953	0	69,700	0	2–31,500; 1–6,700.
Do	do	Polehill	1953	0	33,250	0	1–33,250.
Idaho	Palisades	Palisades	1957	0	114,000	0	4–28,500.
Montana	Missouri River Basin	Canyon Ferry	1953	0	50,000	0	3–16,666.
Do	Hungry Horse	Hungry Horse	1952	0	285,000	0	4–71,250.
Do	Missouri River Basin	Kenil	1959	0	1,600	0	2–800.
Do	do	Tiber	1956	0	2,000	0	3–667.
Do	do	Little Porcupine	1955	0	18,000	0	3–6,000.
Washington	Yakima-Kennewick division.	Chandler	1955	0	12,000	0	2–6,000.
Wyoming	Kendrick	Alcova	1954	0	36,000	0	2–18,000.
Do	Missouri River Basin	Boysen	1953	0	15,000	0	2–7,500.
Subtotal				0	842,050		

UNDER CONSTRUCTION BY CORPS OF ENGINEERS, DEPARTMENT OF THE ARMY; POWER TO BE MARKETED BY BUREAU OF RECLAMATION

North Dakota	Missouri River Basin	Garrison	1955	0	400,000	0	5-80,000.
South Dakota	do	Fort Randall	1953	0	320,000	0	8-40,000.
Do	do	Gavins Point	1956	0	100,000	0	3-33,333.
Do	do	Oahe	1956	0	425,000	0	5-85,000.
Subtotal				0	1,245,000		

AUTHORIZED TO BE CONSTRUCTED BY BUREAU OF RECLAMATION

Colorado	Collbran	Power plant No. 1		0	[12] (5,000)	0	(1-5,000).[12]
Do	do	Power plant No. 2		0	[12] (2,400)	0	(1-2,400).[12]
Do	Colorado-Big Thompson	Big Thompson		0	6,700	0	1-6,700.
Idaho	Minidoka	American Falls	1956	0	30,000	0	4-7,500.
Montana	Missouri River Basin	Lyon	1960	0	24,000	0	3-8,000.
Do	do	Absaroka	1961	0	50,000	0	3-16,667.
Do	do	Portage	1960	0	20,000	0	2-10,000.
Do	do	Yellowtail	1958	0	200,000	0	4-50,000.
Do	do	Moorehead	1957	0	8,000	0	2-4,000.
Nebraska	do	Harlan		0	1,200	0	1-1,200.
North Dakota	do	Crosby		0	48,000	0	6-8,000.
Do	do	Des Lacs		0	60,000	0	6-10,000.
South Dakota	do	Pony Hills	1960	0	180,000	0	4-45,000.
Utah	Weber Basin	Gateway	1955	0	4,000	0	2-2,000.
Do	do	Wanship	1955	0	1,400	0	1-1,400.
Do	Provo River Basin	Deer Creek	1954	0	7,000	0	2-3,500.
Washington	Yakima Roza division	Roza	1956	0	10,000	0	2-5,000.
Wyoming	Missouri River Basin	Bald Ridge	1961	0	30,000	0	3-10,000.
Do	do	Hunter Mountain	1962	0	12,000	0	2-6,000.
Do	do	Sunlight	1960	0	20,000	0	2-10,000.
Do	do	Thief Creek	1960	0	60,000	0	3-20,000.
Do	do	Tongue River	1961	0	25,000	0	2-12,500.
Do	do	Glendo	1958	0	24,000	0	2-12,000.
Do	do	Fremont Canyon	1958	0	48,000	0	2-24,000.
Subtotal				0	869,300		

See footnotes at end of table.

TABLE 10.—Hydroelectric plants on Reclamation projects, operating, under construction, or authorized, as of June 30, 1952—Continued

AUTHORIZED TO BE CONSTRUCTED BY CORPS OF ENGINEERS, DEPARTMENT OF THE ARMY; POWER TO BE MARKETED BY BUREAU OF RECLAMATION

State	Project	Name of plant	Calendar year of initial operation	Nameplate capacity		Number and nameplate capacity of generators	
				Existing (kilowatts)	Ultimate (kilowatts)	Existing (kilowatts)	Ultimate (kilowatts)
California	Central Valley	Iron Canyon		0	45,000	0	3-15,000.
South Dakota	Missouri River Basin	Big Bend	1960	0	120,000	0	6-20,000.
Subtotal				0	165,000		
Total				4,369,527	7,784,177		

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[1] Power plant units operated by power allottees under agency contract.

[2] 27,000 kilowatts authorized; space provided in plant for third unit.

[3] Power marketed by Bonneville Power Administration.

[4] Main units with a nameplate rating at 108,000 kilowatts have continuous operating capacity of 120,000 kilowatts.

[5] Prosser will be removed when Chandler is constructed.

[6] Power plant constructed by Bureau of Reclamation with Salt River Valley Water Users' Association funds.

[7] Unit No. 3 installed in Pacific Power & Light Co.'s Cove No. 2 plant.

[8] Three plants: (*a*) Spanish Fork (upper); (*b*) Spanish Fork (lower); (*c*) Payson.

[9] Salt River Valley Water Users' Association's plant.

[10] Imperial irrigation district's plant.

[11] Enterprise irrigation district's plant.

[12] Approved July 3, 1952. Excluded from total.

Transmission Lines

By June 30, 1952, the Bureau of Reclamation had 6,418.1 miles of high-voltage transmission lines in operation. It was accomplished by the completion of construction and placing in operation 856.14 miles of line and dismantling 18.84 miles of line during fiscal year 1952. Transmission lines placed in operation during the fiscal year are shown in table 11.

TABLE 11.—Transmission lines completed during fiscal year 1952

Project and line	Voltage	Completed	Length
	Kilovolts		*Miles*
Minidoka (Idaho): Albion line to Weeks substation	34. 5	May 1952	1. 00
Central Valley (California): Tracy substation to Ygnacio substation.	69	November 1951	19. 42
Davis Dam (Arizona-California): Gila substation to Wellton to Mohawk.	34. 5	September 1951	21. 10
Rio Grande (New Mexico):			
Socorro substation to Belen substation	115	December 1951	40. 87
Belen substation to Albuquerque substation	115	do	35. 80
Belen substation to Willard substation	115	June 1952	53. 00
Kendrick (Wyoming):			
Seminoe power plant to Sinclair substation	115	April 1952	28. 16
Sinclair substation to Rawlins substation	34. 5	do	9. 93
Hanna substation to Sinclair substation	34. 5	do	34. 88
Colorado-Big Thompson (Colorado):			
Kremmling Tap to Oak Creek substation	115	September 1951	50. 34
Gore Junction to Muddy Pass substation	69	November 1951	21. 31
Missouri River Basin:			
Leeds substation to Rolla substation	69	July 1952	42. 56
Voltaire to Rugby substation	115	April 1952	55. 94
Rugby substation to Devils Lake substation	115	do	58. 76
Devils Lake substation to Carrington substation	115	do	52. 47
Jamestown substation to Edgeley substation	115	do	37. 35
Havre substation to Shelby substation	115	April 1951	98. 60
Alcova power plant to Boysen power plant to Thermopolis	115	January 1952	118. 70
Sidney substation to Ogallala substation to Julesburg	115	December 1951	75. 93
Total			856. 14

Construction was continuing on approximately 2,500 miles of transmission lines at the end of fiscal year 1952. A great number of these lines are scheduled to be placed in operation during fiscal year 1953.

Power Contracts

During fiscal year 1952, 130 contracts for delivery of power were executed. Included among these are 22 contracts with private utilities, 53 contracts with REA cooperatives, 11 with municipalities, 26 with other Federal agencies, 4 with irrigation districts, 4 with public power districts, 2 with State authorities, and 8 miscellaneous-type contracts. Fourteen of the 26 contracts with other Federal agencies were contracts with various Department of Defense agencies throughout the western area of the United States. A number of contracts executed were renewals of operating contracts or revisions of existing contracts resulting from changed operating conditions.

The Bureau continued its policy of contracting whenever possible with private utilities and cooperatives for wheeling power and energy over existing facilities. The Bureau also entered into several interchange agreements with cooperatives and utilities. In the Bureau's region 5 area, which covers Texas, New Mexico, and part of southern Colorado, the Bureau is actively negotiating and has executed several contracts for the sale of supplemental power and energy to augment its hydroelectric generation in the area.

A summary by classification of customers served by Reclamation during 1952 is shown in table 12.

TABLE 12.—Summary by classification of customers for 12 months ending June 30, 1952 [1]

Type of customers	Number of customers	Sales of electric energy	Revenue from sales of electric energy
		Kilowatt-hours	
Privately owned utilities	38	5, 362, 740, 094	$15, 853, 605
Municipal utilities	34	2, 703, 332, 827	5, 067, 015
State government utilities	10	1, 817, 401, 794	5, 749, 957
Cooperative utilities (Rural Electrification Administration projects)	90	352, 101, 701	2, 243, 072
Other Federal utilities	4	14, 181, 279, 769	11, 519, 802
Residential and domestic	445	4, 880, 598	30, 132
Rural (other than Rural Electrification Administration projects)	8	86, 696	765
Commercial and industrial	34	74, 141, 731	436, 345
Public authorities	66	715, 044, 115	2, 099, 079
Interdepartmental	46	121, 194, 985	310, 263
Total all customers	775	25, 332, 204, 310	43, 310, 035

[1] Does not include energy sales and revenues in transactions between Bureau projects.

The Bureau of Reclamation at the end of fiscal year 1952 has 431 contracts under negotiation. In this number are included 192 contracts with municipalities, 131 with REA cooperatives, 32 with private utilities, 29 with public-power districts, 21 with other Federal agencies, 10 with State authorities, 7 with irrigation districts, and 9 miscellaneous-type contracts. A number of these are to renew existing contracts or to revise contracts in existence due to changes in operating conditions. A large number of contracts under negotiation are for future power deliveries at such time as additional generating capacity now under construction is placed in operation. Seventeen of the 21 contracts with other Federal agencies are contracts with various agencies within the Department of Defense.

PROJECT PLANNING

The project-planning program of the Bureau of Reclamation provides for the planning of basin and project developments for utilization of the water resources of the West and of Alaska. Except in the area in the Missouri River Basin project, the activities in the project-planning program are financed with appropriations for general investigations. Recent appropriations for general investigations have been less than the amounts requested in the President's budgets. The size of the appropriations has varied in amount from year to year. Consequently, the program also has been fluctuating in size, whereas it is in the interest of economy and efficiency that the investigation program be kept upon a substantially constant rate basis.

There have been outstanding increases in the population in the West and in Alaska during and since World War II which have aggravated deficiencies in water and electric-power supplies in these regions. In certain areas heavy defense installations have caused new and large demands for additional power and municipal and industrial water, so that the needs for investigations of potential water and power developments are increasing. As a result, there is constant demand from local and State interests throughout the West to continue investigations in progress or to initiate new investigations, or to resume uncompleted investigations deferred because of lack of funds.

The needs for planning are critical throughout the West and Alaska. In the Pacific Northwest, the Bureau's current construction program for development of water and related resources consists almost entirely of the Palisades project and the irrigation features of the Columbia Basin project. The construction of Hungry Horse Dam is nearing completion. Aside from these, the Bureau has no authorized projects other than the relatively small Kennewick Division of the Yakima project and portions of the Minidoka project. In California the initial features of the Central Valley project are practically completed, and construction is continuing on the Folsom Power Plant. In this area, only the Sly Park and Sacremento River canal units, and the Solano project remain authorized for construction. In the entire Colorado River and inland basins, some very small items are under construction, and only the Deer Creek Power Plant, the Weber Basin project, and a few miscellaneous minor items are authorized for construction. In the Southwest, which also is practically without a construction program, the only projects eligible for construction without authorization or reauthorization are the Middle Rio Grande and the Canadian River projects. Thus it is clear that the investigation program is barely keeping ahead of the present reduced construction program, and any further curtailment of the investigation program is sure to have adverse repercussions in the character and size of the future construction programs which are of such great importance in the development of water and related resources of the West.

The general investigation program should proceed undiminished even during times of national stress, as at present, because of the long-range aspects of the program. It requires considerable time to make adequate investigations, and maintenance of an adequate program of investigations is essential to insure the availability of projects for construction in future years. Many of the projects being investigated are needed now, and others will be needed in the future to maintain the essential civilian economy.

Comprehensive River Basin Surveys

During fiscal year 1952 the Bureau of Reclamation has continued the Arkansas, White, and Red River Basin investigations in cooperation with the other interested Federal agencies under the field committee established by the Federal Interagency River Basin Committee on June 12, 1950.

The report on the survey of the Washita River, Okla., a subbasin of the Red River Basin, was completed, reviewed by the affected States and Federal agencies, and transmitted to the President.

The Bureau has under way a number of other basin surveys of western streams.

New Projects Authorized

The report on the Deer Creek Power Plant, Deer Creek division, Provo River project, Utah, was completed and was forwarded to the President by the Secretary with a finding of feasibility authorizing the project under Reclamation law.

Other Project Planning Reports

The reports on the Collbran project in Colorado were submitted to the Congress and were printed as House Document 216, Eighty-second Congress. Reports on the Hells Canyon division and the Scriver Creek power facilities of the Mountain Home division of the Snake River project, Idaho and Oregon, were submitted to the Congress by the Secretary in fiscal year 1952 with recommendations for authorizations of the projects by Congress. Bills were introduced in Congress to authorize these projects, and hearings were held in fiscal year 1952. The bill to authorize the Collbran project was passed by both Houses at the end of the fiscal year and transmitted to the President for signature.

A reconnaissance report on the potential development of the water resources in the Territory of Alaska was submitted to the Congress in July 1951, and is being printed as House Document 197, Eighty-second Congress.

Reports on the Central Valley project (ultimate plan), Kings River division, North Fork Kings unit; Deschutes project, Oregon, domestic water system; Fryingpan-Arkansas project, Colorado (formerly called Gunnison-Arkansas project, Roaring Fork diversion, initial development); and lower Nueces River project, Texas, after review by the affected States and Federal agencies, were forwarded to the President.

Reports on the following eight projects were completed and were under review by the affected States and Federal agencies at the end of fiscal year 1952:

Boise Project, Idaho, Payette division, Payette Heights unit
Canton project, Oklahoma
Central Valley project (ultimate plan), California, Sacramento River division, Sacramento canal unit, Trinity River division
Fort Gibson project, Oklahoma
North Platte project, Nebraska, Braziel Dam and Reservoir
Swan Lake project, Alaska

River Compacts

Interstate-compact activity during fiscal year 1952 was somewhat less than in the previous year. The Bureau of Reclamation continued to give assistance in every way practical to the State and Federal representatives on those compacts in the active stage.

Congressional approval was obtained for the compacts covering the Canadian River in New Mexico, Oklahoma, and Texas, and the Yellowstone River in Montana, North Dakota, and Wyoming, which were ratified by the appropriate State legislatures last year. There was no activity during the year on the Cheyenne River Compact, negotiations for which were completed, but ratification by the Wyoming legislature not obtained. There was little activity on the Bear River Compact.

Congressional approval was obtained for Texas and Louisiana to negotiate a compact on the Sabine and Neches Rivers, and Col. L. W. Prentiss, of the Corps of Engineers, was appointed as Federal representative. The Bureau of Reclamation is interested in this stream because of possible water service to the Coastal Plain to the west. Legislation was passed by the Congress at the close of the year, and Presidential approval has since been given, permitting Idaho, Montana, Oregon, Washington, and Wyoming to enter negotiations toward a compact for the Columbia River and its tributaries.

An interstate suit was brought by Texas against New Mexico in the Supreme Court to require compliance by New Mexico with terms of the Rio Grande Compact. This matter vitally affects the Bureau's Rio Grande project in New Mexico-Texas, below Elephant Butte Reservoir, and the Bureau's Middle Rio Grande project above the reservoir.

Hydrology

Hydrologic studies are vital to the planning and operation of irrigation, hydroelectric power, flood-control or drainage works. During fiscal year 1952 the impounding of 1,000,000 acre-feet of water, on schedule, behind Hungry Horse Dam in Montana, while still under construction, serves as an example of applied hydrology.

Some basic hydrologic studies being conducted by the Bureau of Reclamation include investigations of observed flood peaks and water yield, porosity, and infiltration and retention capacities of soils, meteorology of rainstorms, transportation and deposition of sediment, behavior of ground water, and characteristics of snow. The results of these studies are used to determine the required reservoir and spillway capacities, and the flood frequencies, and for flow forecasting and general operational purposes. Other studies include special surveys and the development, testing, and improvement of methods of utilizing basic data for more precise determination of required capacities. Among these were extensive infiltration surveys made in Wyoming and Montana. Uncertainty regarding the required capacities of reservoirs and spillways may result in overdesign for safety, and infiltration tests provide better information for eliminating some of these uncertainties. A new procedure for computing the daily discharge resulting from snowmelt, based on daily maximum temperatures, is being developed and has already been given a limited application. In general, studies of improved methods are of great importance because the improved procedures will allow greater safety and probably will result in reduced construction costs.

Hydrologic studies of streams in the western United States were continued for the purpose of obtaining the maximum possible beneficial use of the waters of the West for irrigation, power, municipal and industrial uses, fish and wildlife conservation, stream-pollution abatement, recreation, and other incidental uses. In order to improve the bases for its technical work, the Bureau of Reclamation has compiled data and is making studies of the use of water on Federal irrigation projects, and a report on these studies will be issued in fiscal year 1953, which recommends a course of action for improving estimates of water requirements. Other research and special studies were conducted as a basis for solution of the unusual problems accompanying water-resource development.

Collaboration was intensified with the Corps of Engineers and the Weather Bureau upon data-reporting networks. This includes intimate details of hydrologic studies aimed at advanced precision in reservoir and river regulation by the expanding facilities of the Missouri River Basin project. A radio-reporting stream-flow network in the Pecos River drainage basin in New Mexico was activated in cooperation with the Geological Survey. A series of tests were conducted on an experimental radio-transmitting rain and snow gage in the Sacramento River drainage basin below Shasta Dam. The groundwork is being laid for future reservoir and river regulation of the complex system developing in the Columbia River drainage basin, through detailed consideration of hydrologic data-reporting networks. These illustrate the advancements in the hydrology of operation of reservoir and river systems.

The second progress report, covering the 1949 snowmelt season, on studies of snowmelt in the headwaters of the Colorado River was distributed. These studies were conducted in collaboration with the Forest Service.

Detailed evaporation field investigations which were conducted in cooperation with the United States Navy Electronics Laboratory, the Geological Survey, and the Weather Bureau at Lake Hefner, near Oklahoma City, Okla., were terminated at the end of August 1951, and much of the equipment used on these studies was transferred to Lake Mead for use in making a more accurate determination of the evaporation loss from Lake Mead.

International Stream Investigations

The Bureau has continued investigations on development of water resources on international streams on the border of the United States and Canada.

The Canadian Section of the International Joint Commission presented to the United States Section a draft of a proposed treaty for apportionment between the two countries of the waters of the Waterton and Belly Rivers in Montana and Alberta. The United States Section, through its engineering board, field committee, and the State of Montana, took the Canadian proposal under consideration.

Definite-Plan Reports

Project-planning feasibility reports made to secure authorization of a potential project present a comprehensive plan for orderly development and conservation of the water and related resources, with sufficient data and studies to determine probable engineering and financial feasibility to a degree sufficient to enable recommendation for or against proceeding with the potential development. Considerable detailed studies and exploratory work usually remains to be done following this stage before sufficient data are available to start the preparation of final designs and specifications. Therefore, following the authorization of a project, there is need for a report on the additional studies, including investigations and negotiations consummated prior to construction that are required to determine the definite plan of development for the project. Such a report, known as the definite-plan report, is prepared for internal or administrative use on the whole project, or for a unit of the project, depending on the size and complexity of the plans for development of the project.

Definite-plan reports were prepared, reviewed, and approved for the following projects or units in fiscal year 1952:

Gila project, Arizona, Wellton-Mohawk division.
Hungry Horse project, Montana.
Kendrick project, Wyoming, Alcova power plant.
Missouri River Basin project, Frenchman-Cambridge division, Nebraska.

Drafts of several other definite-plan reports were under review at the end of the fiscal year.

Artificial Precipitation and Salt-Water Conversion

Legislative action on artificial precipitation and salt-water conversion progressed considerably during the second session of the Eighty-second Congress. The two subjects were considered individually, and two new bills (S. 2225 and H. R. 6578) on artificial precipitation and salt-water conversion, respectively, were acted upon. S. 2225 was passed by the Senate and was under consideration by the Interstate and Foreign Commerce Committee of the House when the session ended. The Bureau has been represented on the departmental committee on artificial precipitation and has continued to keep abreast of developments in this field of interest to Reclamation.

H. R. 6578 was passed by both Houses in the closing days of the fiscal year and was sent to the President for signature on June 30, 1952. The bill provides for the Secretary of the Interior to conduct a program of research and development to evolve more economical methods of saline-water conversion, the majority of the technical work to be conducted by private organizations. Provision is also made for participation and cooperation by other civil and military agencies of the Federal Government. The bill authorizes the expenditure of $2,000,000 over a period of 5 years to finance the program.

PROGRAMS AND FINANCE

New Accounting Systems

With the substantial completion of the conversion to the new accounting system at hand, as fiscal year 1952 began, the chief efforts of the system's personnel during the fiscal year were focused on improvements and refinements in techniques dictated by experience with the new system and certain qualifications contained in the Comptroller General's approval of the system dated October 6, 1950. Continuous attention was directed to maintain the modern and utility recognized practices as applied to Government accounting and to provide management at the various administrative levels in the Bureau with operational data readily available in the accounts for improved administration of work.

Accounting techniques for depreciation were accorded special consideration, and procedures applicable to revenue-producing property of the Bureau were formulated during the fiscal year and tested in pilot installations. Formal adoption of these procedures in finance offices of the Bureau was made effective July 1, 1952. The Bureau's procedures conform to the depreciation concepts promulgated by the Federal Power Commission and will result in financial statements comparable with those of public-service corporations.

The Bureau of Reclamation has a twofold objective in properly estimating and accounting for depreciation. First, in accordance with the Bureau's continuing policy of adopting sound business practices, it is necessary that the Bureau's statements of financial operations reflect the real cost of rendering service (including depreciation as an expense) rather than reflect only out-of-pocket costs which exclude depreciation as a current expense. Secondly, that the maintenance accounts include only those costs which neither materially add to the value of the property nor appreciably prolong its life, but merely keep it in efficient operating condition, thus enabling administrators to make reasonable comparisons of such costs from year to year.

In order to improve the power-accounting methods of the Bureau, reviews were made in the applicable finance offices to determine the extent of uniformity of the data yielded. In addition, the power-accounting methods and techniques were compared with modern utility-accounting practices. This has resulted in the preparation of cost data which enable the Bureau's administrators to compare the results of operation among power projects and also with that of private utilities in their respective areas.

The increasing attention being given by the Congress to the cost of operation of the various offices of the Bureau, particularly the cost of administrative and general expenses (and personal services as a segment of these expenses), caused the launching of a monthly cost report during the fiscal year on these matters. Each finance office prepares a report from the accounting records which contains prescribed detail accounts to accumulate the data. It is contemplated that the managerial personnel of the Bureau will utilize the information in the reports to obtain necessary data for appraising staffing and operational costs of the activities and offices under their jurisdiction. In addition, the source of financing for defraying the expenses of their various endeavors will also be revealed in the reports. In assembling the reports from the various offices of the Bureau, the regional offices and the Commissioner's office, at their respective levels, are provided ready data for comparing the operating burden in the different areas. Generally, it is expected that reporting of this type will prove a dynamic instrument in aiding the managerial employees of the Bureau to reduce operating costs or improve the effectiveness of controlling them.

In conformance with the emphasis on streamlining the accounting operations of the Federal Government, the on-site audit program of the GAO was expanded in geographical scope during the fiscal year, and effective January 1, 1952, all finance offices of the Bureau were encompassed under it. The Bureau has received reports from the General Accounting Office resulting from the on-site audit of finance offices prior to January 1. These reports were carefully studied by the responsible administrators for appropriate action. In the main the reports disclosed that the accounts of the offices audited are being maintained in a satisfactory condition.

Manualization of Procedures

A factor in the effectiveness of the Bureau's Finance Manual is the manner in which its provisions are kept current with changing regulations prescribed by the Treasury Department, General Accounting Office, Bureau of the Budget, and the Congress. During this fiscal year numerous revisions were made in the manual based on promulgations of these bodies of the Government. In addition, the systems personnel directed their efforts toward self-designed changes and improvements in the manualized procedures resulting from experience gained in actual practice in finance offices and from finance conferences and joint studies conducted by members of the Washington and field staffs.

In the 4 years existence of the new accounting system of the Bureau, many inquiries have been received from individual offices seeking interpretations of the procedures covering special transactions. Hence, in order to coordinate the interpretations and obtain uniform treatment under similar circumstances, the Bureau's Finance Manual is undergoing expansion to incorporate an appendix covering these interpretations. This is another step on the part of the Bureau to conform its accounting and financial practices to those recognized by the various public regulatory commissions, such as Federal Power Commission, which have prescribed uniform systems of accounts.

During the 50 years of the Bureau's existence voluminous files of accounting records and financial documents have been accumulated. The disposition of the accounting material is being approached with careful planning and an eye to probable future need of old records and documents for sundry research and analytical purposes. The first step taken has been to determine the condition of the files and the extent to which these copies can be isolated for disposal. The General Accounting Office and the General Services Administration have approved for use by the Bureau of one Federal Records Center in Denver for all records and documents. Also, the General Accounting Office is instituting a procedure whereby the Bureau will be formally notified of the completion of on-site audits and thereafter the finance offices can proceed with established regulations for retaining and disposing of accounting documents.

The uniformity and standardization expected from a manual are the functions of how the procedures are applied by operating personnel. In full cognizance of this fact regional programs and finance conferences were continued during the fiscal year. These symposiums have produced healthy interest in the Bureau's procedures and have promoted uniformity in the application of programing, budgeting, accounting, and reporting procedures. The practice broadens the perspective of operating personnel with respect to the purposes of the Bureau's manual and permits these employees to appraise the effectiveness of programs and finance beyond the immediate microcosm of the working detail in their offices. This has encouraged self-analysis and has resulted in a marked improvement in the data contained in financial statements and reports. In recognition of these developments the monthly reporting has been considerably simplified and less analysis and review work is required.

Machine accounting was further expanded during the fiscal year to encompass several more finance offices. The benefits anticipated from bookkeeping machines in prior installations have materialized into significant savings in the accounting operation.

Program Procedures

By the beginning of the fiscal year, detailed procedures for the estimating and scheduling of the Bureau's activities had been formalized and placed in use throughout the field offices. Particular attention was devoted to the problem of uniform interpretation and application of those procedures as well as the clarification of points of ambiguity and misunderstandings of the instructions. Substantial progress was made in solving this problem primarily by the visit of Washington office personnel to the field offices and the detail of regional personnel to the Washington office.

During the fiscal year particular attention was also devoted to the problem of improving the realism and accuracy of both the estimating of costs and the scheduling of flag actions.

Much greater emphasis and attention was paid to apportionments of funds than in previous years. This additional workload resulted from the use by the Bureau of the Budget of the apportionment procedures as a means of controlling the Bureau of Reclamation's program in accordance with Presidential policies and criteria. This necessitated closer review and coordination with both the programming and accounting documents.

The only major change in programing procedure was to provide for the identification on the operation and maintenance schedules of the cost of operating multipurpose facilities with an allocation of those costs to all applicable project functions, both reimbursable and nonreimbursable.

TABLE 13.—Schedule of public works construction programs

Name and location of project	Total estimated obligations	Amount available		Amount required		Obligations to June 30, 1952
		Actual to June 30, 1952	Allotments and contributions fiscal year 1953	Allotments and contributions fiscal year 1954	Additional to complete (column 3—columns 4, 5, and 6)	
(1-2)	(3)	(4)	(5)	(6)	(7)	(8)
1. AUTHORIZED PROJECTS						
A. 56 completed projects and divisions	$256, 498, 681	$256, 498, 681				$256, 498, 681
B. Continuing divisions or projects:						
All-American Canal, Ariz.-Calif	70, 160, 056	63, 699, 941	$1, 419, 000		$5, 041, 115	62, 282, 466
Austin, W. C., Okla	12, 073, 904	12, 068, 992	4, 912			12, 043, 904
Boise-Anderson Ranch, Idaho	30, 437, 499	30, 437, 499				30, 025, 721
Boise-Arrowrock Dam, Idaho	167, 250	[1] 30, 000	[1] 137, 250			29, 751
Boise drainage, Idaho	85, 630	85, 875	−44, 293	$5, 000	39, 048	36, 582
Boise-Payette, Idaho	17, 273, 050	17, 271, 913	−103, 237		104, 374	16, 976, 581
Boulder Canyon, Ariz.-Nev	163, 960, 000	158, 826, 680		123, 000	5, 010, 320	158, 476, 009
Buffalo Rapids, First division, Mont	2, 520, 066	2, 182, 783	−24, 000	128, 000	233, 283	1, 918, 516
Buffalo Rapids, Second division, Mont	2, 110, 014	1, 649, 012	111, 000	152, 000	198, 002	1, 645, 050
Cachuma, Calif	36, 761, 400	23, 370, 900	6, 880, 000	6, 510, 500		21, 714, 118
Central Valley, Calif	678, 048, 848	393, 925, 554	26, 756, 922	26, 665, 000	230, 701, 372	383, 504, 038
Colorado-Big Thompson, Colo	164, 151, 730	135, 145, 788	19, 000, 000	5, 750, 000	4, 255, 942	135, 114, 897
Colorado River Front Work and Levee System, Ariz.-Calif.-Nev	12, 190, 000	9, 070, 152	[2] 818, 948	[3] 2, 300, 900		8, 658, 278
Columbia Basin, Wash	757, 050, 000	443, 477, 065	20, 402, 754	21, 930, 000	271, 240, 181	443, 336, 813
Davis Dam, Ariz.-Nev	116, 815, 764	110, 599, 530	554, 330	3, 822, 000	1, 839, 904	106, 682, 653
Deschutes, North unit, Oreg	11, 282, 000	10, 835, 338	−316, 064		762, 726	10, 412, 350
Eden, Wyo	6, 164, 000	3, 917, 614	486, 000	1, 141, 000	619, 386	3, 643, 614
Eklutna, Alaska	33, 751, 695	6, 861, 400	13, 000, 000	12, 791, 000	1, 099, 295	6, 842, 561
Fort Peck, Mont	23, 620, 782	9, 997, 738	−466, 000	750, 000	13, 339, 044	9, 109, 859
Fort Sumner, N. Mex	2, 480, 622	2, 493, 759	−13, 137			2, 477, 760
Gila, Ariz	54, 183, 376	34, 697, 748	5, 582, 000	4, 900, 000	9, 003, 628	33, 243, 575
Hungry Horse, Mont	103, 539, 611	90, 296, 611	12, 570, 000	673, 000		90, 189, 790
Kendrick, Wyo	34, 086, 000	25, 854, 592	3, 750, 000	2, 970, 000	1, 511, 408	25, 505, 400
Kern River, Calif	135, 000	117, 500	−9, 915	10, 000	17, 415	67, 133
Kings River, Calif	252, 764	231, 102	−44, 556	2, 700	63, 518	175, 222
Klamath, Oreg.-Calif	18, 806, 222	14, 336, 059	395, 000	466, 700	3, 608, 463	14, 196, 193
Lewiston Orchards, Idaho	2, 412, 171	2, 424, 171	−12, 000			2, 410, 139
Mancos, Colo	3, 970, 491	3, 920, 721	−230	50, 000		3, 920, 491
Milk River, Fresno Dam, Mont	2, 000, 000	1, 852, 725	−6, 000		153, 275	1, 835, 074
Minidoka, Gooding, Idaho	6, 676, 186	6, 627, 959	−31, 813		80, 040	6, 590, 146
Minidoka-North Side pumping, Idaho	10, 667, 149	[4] 1, 040, 023	180, 153	1, 627, 000	7, 819, 973	934, 931
Mirage Flats, Nebr	3, 178, 343	3, 118, 343		60, 000		3, 118, 343

See footnotes at end of table.

TABLE 13.—Schedule of public works construction programs—Continued

Name and location of project	Total estimated obligations	Amount available		Amount required		Obligations to June 30, 1952
		Actual to June 30, 1952	Allotments and contributions fiscal year 1953	Allotments and contributions fiscal year 1954	Additional to complete (column 3—columns 4, 5, and 6)	
(1-2)	(3)	(4)	(5)	(6)	(7)	(8)
1. AUTHORIZED PROJECTS—continued						
B. Continuing divisions or projects—Continued						
Missouri River Basin, various	$4, 000, 122, 011	$316, 848, 963	[5] $43, 928, 090	$94, 757, 400	$3, 544, 587, 558	$296, 264, 577
Ochoco, Oreg	815, 896	1, 152, 056	−336, 160			814, 896
Palisades, Idaho-Wyo	76, 000, 000	5, 327, 475	9, 900, 000	17, 926, 000	42, 846, 525	5, 305, 292
Paonia, Colo	6, 730, 980	2, 102, 472	−38, 476	7, 600	4, 659, 384	1, 891, 574
Pine River, Colo	3, 339, 957	3, 300, 000	−10, 043	50, 000		3, 289, 957
Provo River, Utah	33, 231, 559	29, 720, 853	[6] 2, 273, 000	380, 200	857, 506	29, 656, 104
Rehabilitation and betterment, various	29, 664, 275	10, 485, 054	[7] 2, 216, 572	2, 993, 000	13, 969, 649	10, 050, 824
Rio Grande, Elephant Butte power, New Mex.-Tex	16, 283, 690	15, 432, 712	101, 171	529, 000	220, 807	15, 378, 375
Riverton, Wyo	24, 676, 000	19, 416, 481	257, 307	1, 635, 000	3, 367, 212	19, 007, 515
San Diego, Calif	15, 969, 300	250, 000	[8] 4, 732, 063	[8] 9, 877, 950	1, 109, 287	25, 563
San Luis Valley, Colo	56, 040, 577	5, 329, 614	−313, 800	215, 000	50, 809, 763	4, 753, 859
Savage Rapids Dam, Oreg	700, 000		700, 000			
Shoshone, Wyo	16, 816, 187	14, 410, 989	474, 111	210, 000	1, 721, 087	14, 221, 078
Solano, Calif	42, 588, 091		3, 000, 000	10, 080, 000	29, 508, 091	
Sun River, Greenfields, Mont	9, 671, 441	9, 557, 726	34, 000	52, 000	27, 715	9, 551, 506
Tucumcari, N. Mex	16, 662, 757	15, 754, 963	351, 000	403, 000	153, 794	15, 750, 276
Vermejo, N. Mex	2, 832, 037	285, 210	406, 789	1, 472, 000	668, 038	35, 804
Weber Basin, Utah	68, 670, 000		1, 350, 000	6, 776, 874	60, 543, 126	
Yakima-Kennewick, Wash	12, 968, 932	314, 003	1, 500, 000	4, 289, 200	6, 865, 729	314, 003
Yakima-Roza, Wash	23, 806, 556	21, 076, 467	−6, 548	881, 000	1, 855, 637	21, 022, 223
Subtotals, continuing divisions or projects	6, 838, 601, 869	2, 091, 230, 125	181, 496, 100	245, 363, 024	4, 320, 512, 620	2, 044, 451, 384
C. New divisions or projects:						
Canadian River, Tex	84, 237, 684				84, 237, 684	
Carlsbad-Alamogordo Dam, N. Mex	1, 746, 000				1, 746, 000	
Collbran, Colo	15, 894, 000			800, 000	15, 094, 000	
Middle Rio Grande, N. Mex	29, 092, 213	1, 463, 000	[9] 2, 125, 000		25, 504, 213	949, 111
Minidoka-American Falls power, Idaho	8, 535, 000	385, 752		853, 000	7, 296, 248	385, 752
Subtotal, new divisions or projects	139, 504, 897	1, 848, 752	2, 125, 000	1, 653, 000	133, 878, 145	1, 334, 863
Total, authorized divisions and projects	7, 234, 605, 447	2, 349, 577, 558	183, 621, 100	247, 016, 024	4, 454, 390, 765	2, 302, 284, 928

MISSOURI RIVER BASIN

Phase A—Units ready for or under construction:						
Bighorn Basin division:						
Bluff unit, Wyoming	$663,000	$33,708	$11,000	$15,000	$603,292	$29,965
Hanover unit, Wyoming	2,313,000	140,586	9,000	21,000	2,142,414	129,931
Owl Creek unit, Wyoming	3,420,000	1,473,398	−736,000	144,500	2,538,102	712,589
Bostwick division: Nebraska-Kansas	56,005,322	11,641,033	2,465,000	6,667,000	35,232,289	10,191,627
Boysen division: Boysen unit, Wyoming	34,121,516	33,608,516	−89,000	108,000	494,000	32,728,319
Cannonball division: Cannonball unit, North Dakota	12,175,000	819,772	−235,000	55,000	11,535,228	583,958
Cheyenne division:						
Angostura unit, South Dakota	13,579,779	11,858,779	1,108,000	29,000	584,000	11,808,329
Keyhole unit, Wyoming	4,453,966	4,561,966	−222,000	23,000	91,000	4,228,431
Rapid Valley unit, South Dakota	12,173,827	530,827	1,000,000	4,230,000	6,413,000	434,809
Frenchman-Cambridge division, Nebraska	71,843,225	43,961,726	3,143,000	6,665,300	18,073,199	42,965,901
Grand division: Shadehill unit, South Dakota	11,445,000	7,479,971	−26,000	397,000	3,594,029	7,410,966
Heart division:						
Dickinson unit, North Dakota	1,694,000	1,349,805	−24,000	1,000	367,195	1,323,000
Heart Butte unit, North Dakota	6,100,000	4,490,833	−235,000	557,000	1,287,167	3,887,112
Helena-Great Falls division: Canyon Ferry unit, Montana	29,187,311	23,338,011	4,754,000	957,000	138,300	21,640,967
Lower Bighorn division: Yellowtail unit, Montana	114,039,015	2,274,015		7,035,000	104,730,000	2,094,878
Marias division: Lower Marias unit, Montana	64,583,533	2,843,083	2,200,000	8,461,000	51,079,450	2,446,191
Middle Loup division: Sargent unit, Nebraska	12,622,662	587,877	216,500	206,000	11,612,285	576,457
Missouri-Souris division:						
Jamestown unit, North Dakota	8,660,000	896,746	1,880,000	2,022,000	3,861,254	894,829
Missouri diversion unit, Montana	115,225,000	2,084,884	1,510,000	5,453,000	106,177,116	1,570,407
Montana pumping division:						
Charley Creek unit, Montana	258,000	37,000	−5,000	15,000	211,000	20,785
Nickwall unit, Montana	825,000	59,730	11,000	21,000	733,270	46,613
Moreau division: Bixby unit, South Dakota	13,105,231	1,414,231	−95,000		11,786,000	1,315,254
North Dakota pumping division: Fort Clark unit, North Dakota	682,000	526,740	135,000		20,260	526,693
Oregon Trail division:						
Glendo unit, Wyoming	48,250,000	1,054,533	−190,000	400,000	46,985,467	672,807
Kortes unit, Wyoming	14,623,961	14,628,961	−5,000			14,609,510
Powder division: Moorhead unit, Montana-Wyoming	30,237,514	1,661,582	−60,000	407,000	28,228,932	1,574,859
Smoky-Hill division:						
Cedar Bluff unit, Kansas	18,060,750	15,607,074	−1,725,419	30,000	4,149,095	13,716,360
Wilson unit, Kansas	16,304,000	118,492	48,700	370,000	15,766,808	118,492
Solomon division:						
Glen Elder unit, Kansas	42,230,000	157,356	20,000	300,000	41,752,644	157,356
Kirwin unit, Kansas	22,695,000	2,996,484	2,900,000	8,359,000	8,439,516	1,736,578
Webster unit, Kansas	21,167,000	156,343	1,500,000	6,080,000	13,430,657	156,343
South Platte division: Narrows unit, Colorado	43,834,000	1,245,930	13,085	190,000	42,384,985	1,074,075
Three Forks division: Crow Creek pump unit, Montana	1,711,523	261,523	725,000	673,000	52,000	152,635
Transmission division: various	339,346,768	48,400,534	[10] 18,936,376	22,217,000	249,792,858	45,026,949
Upper Republican division: St. Francis unit, Colorado-Kansas	15,261,797	14,649,017	−1,305,798	35,000	1,883,578	13,261,763
Yellowstone division:						
Cartwright unit	415,601	250,159	−133,739		299,181	116,420
Sadie Flat unit, Montana	1,764,070	195,370		25,000	1,543,700	193,863
Savage unit, Montana	504,705	476,405	2,000		26,300	474,214
Sidney unit, Montana	797,193	201,728	−22,000	23,000	594,465	160,388
Subtotal, phase A	1,206,379,269	258,074,728	37,478,705	82,191,800	828,634,036	240,770,623

See footnotes at end of table.

TABLE 13.—Schedule of public works construction programs—Continued

Name and location of project	Total estimated obligations	Amount available		Amount required		Obligations to June 30, 1952
		Actual to June 30, 1952	Allotments and contributions fiscal year 1953	Allotments and contributions fiscal year 1954	Additional to complete (column 3—columns 4, 5, and 6)	
(1-2)	(3)	(4)	(5)	(6)	(7)	(8)
MISSOURI RIVER BASIN—continued						
Phase B—Units being prepared for construction	$771, 621, 317	$10, 723, 634	—$172, 017	$2, 708, 600	$758, 361, 100	$8, 627, 569
Phases C and D—Continuing work on general plan of development	1, 722, 121, 425	17, 389, 936	1, 621, 402	3, 831, 000	1, 699, 279, 087	16, 539, 118
Total, Missouri River Basin (Bureau of Reclamation)	3, 700, 122, 011	286, 188, 298	38, 928, 090	88, 731, 400	3, 286, 274, 223	265, 937, 310
Participating agencies	300, 000, 000	30, 660, 665	5, 000, 000	6, 026, 000	258, 313, 335	30, 327, 267
Grand total, Missouri River Basin	4, 000, 122, 011	316, 848, 963	[11] 43, 928, 090	94, 757, 400	3, 544, 587, 558	296, 264, 577
2. PROJECTS NOT YET AUTHORIZED						
Region 1:						
Snake River project, Idaho-Oregon:						
Mountain Home division	$253, 243, 000	$437, 153	$2, 847	$150, 000	$252, 653, 000	$437, 153
Hells Canyon division	356, 810, 000	290, 967	10, 033	6, 000, 000	350, 509, 000	290, 967
Crooked River project, Oregon	5, 884, 000	180, 780	7, 220	300, 000	5, 396, 000	180, 780
Upper Star Valley project, Wyoming	3, 892, 000	94, 115			3, 797, 885	94, 115
The Dalles project, Oregon, Western division	2, 573, 000	81, 514			2, 491, 486	81, 514
Bitterroot Valley project, Montana	8, 979, 000	194, 867	2, 150	1, 983	8, 780, 000	194, 867
Cambridge Bench project, Idaho	544, 000	30, 933			513, 067	30, 933
Council project, Idaho	1, 998, 000	66, 400			1, 931, 600	66, 400
Kalispell project, Montana	17, 635, 000	246, 080	3, 920		17, 385, 000	246, 080
Baker project, Oregon, Upper division	4, 676, 000	209, 415	12, 010	575	4, 454, 000	209, 415
Rogue River Basin project, Oregon:						
Talent division	9, 000, 000	305, 683	38, 408	4, 909	8, 651, 000	305, 683
Union Peak division, Cascade Gorge unit	6, 000, 000	27, 345	32, 504	2, 151	5, 938, 000	27, 345
Deschutes project, Oregon, domestic water system	3, 519, 000	13, 476		350, 000	3, 155, 524	13, 476
Foster Creek project, Washington	4, 600, 000	69, 958	8, 042		4, 522, 000	69, 958
Michaud Flats project, Idaho	4, 300, 000	89, 047	29, 953		4, 181, 000	89, 047
Rathdrum Prairie project, Idaho	6, 800, 000	254, 224	9, 401	1, 375	6, 535, 000	254, 224
Columbia Basin project, Washington:						
Grand Coulee Dam modifications for flood control	2, 750, 000				2, 750, 000	
Third powerhouse, Grand Coulee Dam (10 units)	178, 500, 000	39, 648	172, 000		178, 288, 352	39, 648
Total, region 1	871, 703, 000	2, 631, 605	328, 488	6, 810, 993	861, 931, 914	2, 631, 605

Region 2:						
Central Valley project, California (Ultimate plan):						
American River division:						
Folsom Canals unit	56, 200, 000	117, 531	135, 000	54, 469	55, 893, 000	117, 531
Union Valley unit	53, 900, 000	173, 108	30, 000	9, 892	53, 687, 000	173, 108
Calaveras River division, New Hogan unit	11, 250, 000	------	------	------	11, 250, 000	------
Kings River division, North Fork Kings unit	195, 769, 000	143, 771	------	------	195, 625, 229	143, 771
San Luis division	246, 500, 000	278, 809	100, 000	56, 191	246, 065, 000	278, 809
Stony Creek division, Black Butte unit	9, 000, 000	36, 540	------	25, 000	8, 938, 460	36, 540
Trinity River division	139, 400, 000	401, 167	14, 833	------	138, 984, 000	401, 167
Santa Maria project, California	14, 300, 000	373, 226	1, 774	250, 000	13, 675, 000	373, 226
Total, region 2	726, 319, 000	1, 524, 152	281, 607	395, 552	724, 117, 689	1, 524, 152
Region 3:						
Central Arizona project, Arizona-New Mexico:						
Bridge Canyon division	354, 700, 000	[13] 1, 636, 822	187, 178	450, 000	352, 426, 000	[13] 1, 636, 822
McDowell, Buttes, Granite Reef aqueduct transmission lines	469, 000, 000	------	------	253, 000	468, 747, 000	------
Other divisions	97, 700, 000	------	------	------	97, 700, 000	------
Dixie project, Utah	27, 303, 000	272, 640	3, 360	80, 000	26, 947, 000	272, 640
Fort Mohave project, Nevada	453, 000	64, 780	3, 220	5, 000	380, 000	64, 780
Marble Canyon project, Arizona	125, 000, 000	594, 803	151, 197	15, 000	124, 239, 000	594, 803
Total, region 3	1, 074, 156, 000	2, 569, 045	344, 955	803, 000	1, 070, 439, 000	2, 569, 045
Region 4:						
Bear River project, Utah-Idaho	110, 000, 000	514, 218	125, 000	135, 000	109, 225, 782	514, 218
Central Utah project, Utah, initial phase	217, 300, 000	953, 522	107, 478	300, 000	215, 939, 000	953, 522
Colorado River storage project:						
Green division:						
Echo Park unit, Colorado-Utah	180, 780, 000	116, 290	22, 710	150, 000	180, 491, 000	116, 290
Flaming Gorge unit, Utah-Wyoming	90, 390, 000	84, 680	------	------	90, 305, 320	84, 680
Middle River division, Glen Canyon unit, Arizona-Utah	397, 740, 000	184, 007	5, 993	165, 000	397, 385, 000	184, 007
San Juan division, Navajo unit, New Mexico-Colorado	68, 860, 000	19, 580	------	50, 000	68, 790, 420	19, 580
Florida project, Colorado	6, 790, 000	31, 216	------	------	6, 758, 784	31, 216
Fruitgrowers Dam project extension, Colorado	1, 770, 000	46, 868	6, 132	------	1, 717, 000	46, 868
Gooseberry project, Utah	5, 200, 000	73, 532	3, 000	2, 000	5, 121, 468	73, 532
Hammond project, N. Mex	2, 070, 000	17, 325	------	------	2, 052, 675	17, 325
Humboldt project, Nevada	3, 400, 000	166, 910	4, 090	------	3, 229, 000	166, 910
Lyman project, Wyoming	10, 760, 000	111, 400	------	60, 000	10, 588, 600	111, 400
Pine River project extension, Colorado-New Mexico	4, 470, 000	78, 844	------	90, 000	4, 301, 156	78, 844
Seedskadee project, Wyoming	22, 270, 000	196, 584	------	------	22, 073, 416	196, 584
Silt project, Colorado	3, 490, 000	65, 635	------	------	3, 424, 365	65, 635
Smith Fork project, Colorado	3, 440, 000	100, 917	------	------	3, 339, 083	100, 917
Washoe project, California-Nevada	60, 000, 000	279, 176	227, 000	233, 000	59, 260, 824	279, 176
Total, region 4	1, 188, 730, 000	3, 040, 704	501, 403	1, 185, 000	1, 184, 002, 893	3, 040, 704

See footnotes at end of table.

TABLE 13.—Schedule of public works construction programs—Continued

Name and location of project (1-2)	Total estimated obligations (3)	Amount available		Amount required		Obligations to June 30, 1952 (8)
		Actual to June 30, 1952 (4)	Allotments and contributions fiscal year 1953 (5)	Allotments and contributions fiscal year 1954 (6)	Additional to complete (column 3—columns 4, 5, and 6) (7)	
2. PROJECTS NOT YET AUTHORIZED—continued						
Region 5:						
Canton project, Oklahoma	$4, 671, 000	$184, 045			$4, 486, 955	$184, 045
Fort Cobb project, Oklahoma	16, 498, 000				16, 498, 000	
Foss project, Oklahoma	21, 694, 000	50, 861			21, 643, 139	50, 861
Lower Nueces River project, Texas	42, 692, 000	220, 883	$7, 600	$400, 000	42, 063, 517	220, 883
Norman project, Oklahoma	6, 000, 000				6, 000, 000	
Nueces River power project, Texas	10, 000, 000	59, 513	10, 300		9, 930, 187	59, 513
San Juan-Chama project, Colorado-New Mexico	228, 141, 000	531, 410	187, 408	377, 000	227, 045, 182	531, 410
Total, region 5	329, 696, 000	1, 046, 712	205, 308	777, 000	327, 666, 980	1, 046, 712
Region 6: None.						
Region 7: Fryingpan-Arkansas project, Colorado	159, 390, 000	799, 748	32, 034	1, 022, 000	157, 536, 218	799, 748
Total, region 7	159, 390, 000	799, 748	32, 034	1, 022, 000	157, 536, 218	799, 748
Alaska District:						
Blue Lake project, Alaska	12, 000, 000	18, 264	152, 736		11, 829, 000	18, 264
Devil Canyon project, Alaska	180, 000, 000		24, 000	375, 000	179, 601, 000	
Lake Dorothy project, Alaska	16, 200, 000	35, 894	23, 106	700, 000	15, 441, 000	35, 894
Power Creek project, Alaska	3, 550, 000			50, 000	3, 500, 000	
Swan Lake project, Alaska	13, 562, 000	91, 146			13, 470, 854	91, 146
Total, Alaska district	225, 312, 000	145, 304	199, 842	1, 125, 000	223, 841, 854	145, 304
Total, projects not yet authorized	4, 575, 306, 000	11, 757, 270	1, 893, 637	12, 118, 545	4, 549, 536, 548	11, 757, 270

TABLE 13.—Schedule of public works construction programs—Continued

Name and location of project	Estimated obligations							
	1953	1954	1955	1956	1957	1958	1959	Balance to complete or projects not scheduled
(1–2)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
1. AUTHORIZED PROJECTS								
A. 56 completed projects and divisions								
B. Continuing divisions or projects:								
All-American Canal, Ariz.-Calif	$2,434,298	$133,380	$9,000	$9,000	$10,000	$10,000	$10,000	$5,261,912
Austin, W. C., Oklahoma	30,000							
Boise-Anderson Ranch, Idaho	411,778							
Boise-Arrowrock Dam, Idaho	128,249	9,250						
Boise drainage, Idaho	5,000	5,000						39,048
Boise-Payette, Idaho	192,095		104,374					
Boulder Canyon, Ariz.-Nev	350,671	123,000	1,297,000	3,497,000	216,320			
Buffalo Rapids, First division, Montana	240,267	128,000	81,000	80,000	72,283			
Buffalo Rapids, Second division, Montana	114,962	152,000	139,002	59,000				
Cachuma, Calif	8,500,000	6,547,282						
Central Valley, Calif	26,996,431	36,847,007	41,022,203	75,206,732	64,292,389	29,413,155	11,058,503	9,708,390
Colorado-Big Thompson, Colo	19,030,891	5,750,000	1,550,000					2,705,912
Colorado River Front Work and Levee System, Arizona-California-Nevada	1,230,822	2,300,900						
Columbia Basin, Wash	20,543,006	21,930,000	12,800,000	11,300,000	13,400,000	11,500,000	13,300,000	208,940,181
Davis Dam, Ariz.-Nev	4,471,207	3,822,000	1,302,052	537,852				
Deschutes-North unit, Oregon	81,924	25,000	20,000	20,000				722,726
Eden, Wyo	760,000	1,141,000	400,386	219,000				
Eklutna, Alaska	13,018,839	12,791,000	1,099,295					
Fort Peck, Mont	421,879	750,000	4,345,000	3,556,000	10,000	220,000	662,000	4,546,044
Fort Sumner, N. Mex	2,862							
Gila, Ariz	7,036,173	4,900,000	2,996,671	3,097,845	1,652,905	741,663	243,661	270,883
Hungry Horse, Mont	12,676,821	673,000						
Kendrick, Wyo	4,099,192	2,970,000	530,000	450,000	340,000	191,408		
Kern River, Calif	40,452	10,000	17,415					
Kings River, Calif	9,000	5,024	63,518					
Klamath, Oreg.-Calif	534,866	466,700	516,000	18,300				3,074,163
Lewiston Orchards, Idaho	2,032							
Mancos, Colo		50,000						
Milk River, Fresno Dam, Mont	11,651							153,275
Minidoka, Gooding, Idaho	6,000							80,040
Minidoka-North Side pumping, Idaho	285,245	1,627,000	1,888,780	2,278,147	1,784,000	1,080,000	732,699	56,347

TABLE 13.—Schedule of public works construction programs—Continued

Name and location of project (1-2)	Estimated obligations 1953 (9)	1954 (10)	1955 (11)	1956 (12)	1957 (13)	1958 (14)	1959 (15)	Balance to complete or projects not scheduled (16)
1. AUTHORIZED PROJECTS—continued								
B. Continuing divisions or projects—Continued								
Mirage Flats, Nebr.		$60,000						
Missouri River Basin, various	$64,512,476	94,757,400	$201,086,445	$236,724,273	$205,862,556	$185,881,947	$165,920,495	$2,549,111,842
Ochoco, Oreg.	1,000							
Palisades, Idaho-Wyo.	9,922,183	17,926,000	20,338,000	15,348,088	6,578,889	581,548		
Paonia, Colo.	170,000	10,022	137,606	1,697,542	1,897,000	927,236		
Pine River, Colo.		50,000						
Provo River, Utah	2,313,000	404,949	431,388	426,118				
Rehabilitation and betterment, various	2,648,802	2,995,000	2,608,000	1,550,000	1,700,000	1,700,000	1,700,000	4,711,649
Rio Grande, Elephant Butte power, New Mexico-Texas	139,008	545,500	220,807					
Riverton, Wyo.	666,273	1,635,000	2,089,981	1,257,731	19,500			
San Diego, Calif.	4,956,500	9,877,950	1,109,287					
San Luis Valley, Colo.	261,955	215,000	551,371	8,800,000	12,939,000	12,800,000	10,800,000	4,919,392
Savage Rapids Dam, Oreg.	638,062	61,938						
Shoshone, Wyo.	664,022	210,000	12,249					1,708,838
Solano, Calif.	3,000,000	10,080,000	13,165,091	10,257.000	3,810,000		2,276,000	
Sun River, Greenfields, Mont.	40,220	52,000	27,715					
Tucumcari, N. Mex.	355,687	403,000	153,794					
Vermejo, N. Mex.	656,195	1,472,000	409,038					259,000
Weber Basin, Utah	1,350,000	6,776,874	12,787,126	11,856,000	7,289,000	7,870,000	7,616,000	13,125,000
Yakima-Kennewick, Wash.	1,500,000	4,289,200	4,720,744	2,144,985				
Yakima-Roza, Wash.	35,040	893,656	1,067,062	665,000	123,575			
Subtotals, continuing divisions or projects	217,497,036	255,872,032	331,097,400	391,055,613	321,997,417	252,916,957	214,319,358	2,809,394,672
C. New divisions or projects:								
Canadian River, Tex.			1,500,000	10,164,000	24,787,500	26,640,184	15,208,000	5,938,000
Carlsbad-Alamogordo Dam, N. Mex.			446,000	1,300,000				
Collbran, Colo.		800,000	2,505,000	4,760,000	5,725,000	2,104,000		
Middle Rio Grande, N. Mex.	2,526,889	112,000	8,198,000	2,939,000	2,045,130	3,895,000	2,274,400	6,152,683
Minidoka-American Falls power, Idaho		853,000	2,375,000	2,475,000	2,446,248			
Subtotal, new divisions or projects	2,526,889	1,765,000	15,024,000	21,638,000	35,003,878	32,639,184	17,482,400	12,090,683
Total, authorized divisions and projects	220,023,925	257,637,032	346,121,400	412,693,613	357,001,295	285,556,141	231,801,758	2,821,485,355

MISSOURI RIVER BASIN								
Phase A—Units ready for or under construction:								
Bighorn Basin division:								
Bluff unit, Wyoming	14, 743	15, 000	331, 000	254, 000	17, 000	1, 292		
Hanover unit, Wyoming	19, 655	21, 000	1, 191, 000	790, 000	159, 000	2, 414		
Owl Creek unit, Wyoming	24, 809	144, 500	1, 221, 200	1, 048, 902	268, 000			
Bostwick division: Nebraska-Kansas	3, 914, 406	6, 667, 000	7, 400, 674	6, 310, 000	7, 854, 452	7, 122, 475	3, 049, 363	3, 495, 325
Boysen division: Boysen unit, Wyoming	791, 197	108, 000	135, 000	133, 000	146, 000	80, 000		
Cannonball division: Cannonball unit, North Dakota	814	55, 000	225, 000	1, 690, 000	2, 880, 000	2, 880, 000	2, 550, 000	1, 310, 228
Cheyenne division:								
Angostura unit, South Dakota	1, 158, 450	29, 000	95, 000	36, 000	39, 000	75, 000	10, 000	329, 000
Keyhole unit, Wyoming	111, 535	23, 000	51, 000	17, 000	23, 000			
Rapid Valley unit, South Dakota	1, 096, 018	4, 230, 000	4, 010, 000	1, 324, 000	787, 000	193, 000	25, 000	74, 000
Frenchman-Cambridge division: Nebraska	4, 138, 825	6, 665, 300	3, 758, 329	5, 161, 289	2, 973, 185	229, 375	144, 324	5, 806, 697
Grand division: Shadehill unit, South Dakota	43, 005	397, 000	123, 000	28, 000	13, 000	13, 000	13, 000	3, 404, 029
Heart division:								
Dickinson unit, North Dakota	2, 805	1, 000	50, 000	55, 000	26, 000			236, 195
Heart Butte unit, North Dakota	368, 721	557, 000	705, 000	550, 000	32, 167			
Helena-Great Falls division: Canyon Ferry unit, Montana	6, 451, 044	957, 000	57, 000	67, 000	14, 000	300		
Lower Bighorn division: Yellowtail unit, Montana	179, 137	7, 035, 000	20, 596, 000	33, 066, 000	32, 847, 000	16, 579, 000	1, 542, 000	100, 000
Marias division: Lower Marias unit, Montana	2, 596, 892	8, 461, 000	14, 424, 000	10, 115, 000	9, 500, 000	3, 685, 000	2, 189, 000	11, 166, 450
Middle Loup division: Sargent unit, Nebraska	227, 920	206, 000	3, 365, 250	2, 059, 988	456, 500	8, 000	8, 000	5, 714, 547
Missouri-Souris division:								
Jamestown unit, North Dakota	1, 881, 917	2, 022, 000	94, 000	38, 000	33, 000	36, 000	24, 000	3, 636, 254
Missouri diversion unit, Montana	2, 024, 477	5, 453, 000	9, 532, 000	9, 905, 000	6, 935, 000	9, 810, 000	14, 930, 000	55, 065, 116
Montana pumping division:								
Charley Creek unit, Montana	11, 215	15, 000	111, 107	75, 893				24, 000
Nickwall unit, Montana	24, 117	21, 000	283, 000	372, 000				78, 270
Moreau division: Bixby unit, South Dakota	3, 977							11, 786, 000
North Dakota pumping division: Fort Clark unit, North Dakota	135, 047					20, 260		
Oregon Trail division:								
Glendo unit, Wyoming	191, 726	400, 000	5, 525, 000	13, 400, 000	11, 800, 000	10, 485, 467	5. 775, 000	
Kortes unit, Wyoming	14, 451							
Powder division: Moorhead unit, Montana-Wyoming	26, 723	407, 000	11, 864, 000	11, 396, 488	4, 953, 444	15, 000		
Smoky-Hill division:								
Cedar bluff unit, Kansas	165, 295	30, 000	207, 000	722, 000	1, 635, 000	961, 543	24, 270	599, 282
Wilson unit, Kansas	48, 700	370, 000	4, 100, 000	7, 930, 000	2, 726, 808			1, 010, 000
Solomon division:								
Glen Elder unit, Kansas	20, 000	300, 000	9, 667, 644	12, 025, 000	9, 990, 000	4, 721, 000		5, 349, 000
Kirwin unit, Kansas	4, 159, 906	8, 359, 000	4, 597, 589	2, 082, 094	850, 000	297, 833	5, 000	607, 000
Webster unit, Kansas	1, 500, 000	6, 080, 000	8, 240, 657	2, 265, 000				2, 925, 000
South Platte division: Narrows unit, Colorado	184, 940	190, 000	2, 950, 000	7, 000, 000	7, 200, 000	6, 500, 000	6, 100, 000	12, 634, 985
Three Forks division: Crow Creek pump unit, Montana	833, 888	673, 000	22, 000	10, 000	10, 000	10, 000		
Transmission division: various	22, 309, 961	22, 217, 000	56, 974, 695	47, 444, 563	12, 419, 000	15, 761, 016	14, 817, 000	102, 376, 584
Upper Republican division: St. Francis unit, Colorado-Kansas	81, 456	35, 000	85, 000	399, 000	978, 000	363, 344	16, 000	42, 234
Yellowstone division:								
Cartwright unit								299, 181
Sadie Flat unit, Montana	1, 507	25, 000	269, 000	752, 000	220, 000	23, 000	5, 000	274, 700
Savage unit, Montana	4, 191		26, 300					
Sidney unit, Montana	19, 340	23, 000	183, 000	355, 000	16, 000	2, 000	38, 465	
Subtotal, phase A	54, 782, 810	82, 191, 800	172, 470, 445	178, 877, 217	117, 801, 556	79, 875, 319	51, 265, 422	228, 344, 077

TABLE 13.—Schedule of public works construction programs—Continued

Name and location of project	Estimated obligations							
	1953	1954	1955	1956	1957	1958	1959	Balance to complete or projects not scheduled
(1-2)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
MISSOURI RIVER BASIN—continued								
Phase B—Units being prepared for construction	$1, 924, 048	$2, 708, 600	$14, 304, 000	$42, 044, 550	$60, 050, 000	$46, 885, 628	$28, 284, 503	$566, 792, 419
Phases C and D—Continuing work on general plan of development	2, 472, 220	3, 831, 000	4, 312, 000	5, 802, 506	18, 011, 000	49, 121, 000	76, 370, 570	1, 545, 662, 011
Total, Missouri River Basin (Bureau of Reclamation)	59, 179, 078	88, 731, 400	191, 086, 445	226, 724, 273	195, 862, 556	175, 881, 947	155, 920, 495	2, 340, 798, 507
Participating agencies	5, 333, 398	6, 026, 000	10, 000, 000	10, 000, 000	10, 000, 000	10, 000, 000	10, 000, 000	208, 313, 335
Grand total, Missouri River Basin	64, 512, 476	94, 757, 400	201, 086, 445	236, 724, 273	205, 862, 556	185, 881, 947	165, 920, 495	2, 549, 111, 842
2. PROJECTS NOT YET AUTHORIZED								
Region 1:								
Snake River project, Idaho-Oregon:								
Mountain Home division	2, 847	150, 000	100, 000	8, 500, 000	16, 280, 000	21, 060, 000	6, 900, 000	199, 813, 000
Hells Canyon division	10, 033	[12] 6, 000, 000	37, 045, 000	71, 250, 000	92, 547, 000	91, 353, 000	40, 120, 000	18, 194, 000
Crooked River project, Oregon	7, 220	300, 000	101, 000	1, 091, 000	2, 212, 100	1, 564, 000	427, 900	
Upper Star Valley project, Wyoming				200, 000	105, 000	559, 000	2, 571, 000	362, 885
The Dalles project, Oregon, Western division						225, 000	775, 000	1, 491, 486
Bitterroot Valley project, Montana	2, 150	1, 983			461, 000	179, 000	1, 360, 000	6, 780, 000
Cambridge Bench project, Idaho						68, 000	338, 000	107, 067
Council project, Idaho					138, 000	40, 000	622, 000	1, 131, 600
Kalispell project, Montana	3, 920			300, 000	250, 000	772, 000	5, 816, 000	10, 247, 000
Baker project, Oregon, Upper division	12, 010	575	250, 000	500, 000	2, 500, 000	949, 000	255, 000	
Rogue River Basin project, Oregon:								
Talent division	38, 408	4, 909	250, 000	100, 000	1, 750, 000	3, 500, 000	2. 000, 000	1, 051, 000
Union Peak division, Cascade Gorge unit	32, 504	2, 151		200, 000	2, 500, 000	3, 000, 000	238, 000	
Deschutes project, Oregon, domestic water system		350, 000	2, 555, 600	500, 000	99, 924			
Foster Creek project, Washington	8, 042		200, 000	20, 000	2, 000, 000	2, 000, 000	302, 000	
Michaud Flats project, Idaho	29, 953			150, 000	1, 500, 000	1, 750, 000	781, 000	
Rathdrum Prairie project, Idaho	9, 401	1, 375		200, 000	150, 000	700, 000	800, 000	4, 685, 000
Columbia Basin project, Washington:								
Grand Coulee Dam modifications for flood control			250, 000	2, 000, 000	500, 000			
Third powerhouse, Grand Coulee Dam (10 units)	172, 000		1, 000, 000	24, 000, 000	48, 000, 000	50, 000, 000	40, 000, 000	15, 288, 352
Total, region 1	328, 483	6, 810, 993	41, 751, 600	109, 011, 000	170, 993, 024	177, 719, 000	103, 305, 900	259, 151, 390

Region 2:								
Central Valley project, California (ultimate plan):								
American River division:								
Folsom Canals unit	135, 000	54, 469		300, 000	900, 000	6, 400, 000	10, 000, 000	38, 293, 000
Union Valley unit	30, 000	9, 892	700, 000	2, 000, 000	11, 700, 000	15, 000, 000	15, 000, 000	9, 287, 000
Calaveras River division, New Hogan unit			50, 000	40, 000	20, 000	500, 000	1. 500, 000	9, 140, 000
Kings River division, North Fork Kings unit			2, 825, 000	17, 150, 000	28, 970, 000	42, 973, 000	43, 430, 000	60, 277, 229
San Luis division	100, 000	56, 191		1, 100, 000	5, 200, 000	6, 500, 000	10, 000, 000	223, 265, 000
Stony Creek division, Black Butte unit		25, 000	29, 460			25, 000	29, 757	8, 854, 243
Trinity River division	14, 833		300, 000	7, 600, 000	22, 800, 000	36, 200, 000	40, 000, 000	32, 084, 000
Santa Maria project, California	1, 774	250, 000	3, 000, 000	4, 500, 000	6, 175, 000			
Total, region 2	281, 607	395, 552	6, 904, 460	32, 690, 000	75, 765, 000	107, 598, 000	119, 959, 757	381, 200, 472
Region 3:								
Central Arizona project, Arizona-New Mexico:								
Bridge Canyon division	187, 178	450, 000	450, 000	20, 000, 000	25, 000, 000	25, 000, 000	25, 000, 000	256, 976, 000
McDowell, Buttes, Granite Reef aqueduct transmission lines		253, 000	253, 000	20. 000, 000	30, 000. 000	50, 000, 000	50, 000, 000	318, 494, 000
Other divisions				253, 000	253, 000	253, 000	403, 000	96, 538, 000
Dixie project, Utah	3, 360	80, 000	120, 000	4, 500, 000	6, 500, 000	8, 500, 000	7, 000, 000	327, 000
Fort Mohave project, Nevada	3, 220	5, 000	35, 000	250, 000	95, 000			
Marble Canyon project, Arizona	151, 197	15, 000	24, 000	304, 000	284, 000	14, 000	3, 000, 000	120, 613, 000
Total, region 3	344, 955	803, 000	882, 000	45, 307, 000	62, 132. 000	83, 767, 000	85, 403, 000	792, 948, 000
Region 4:								
Bear River project, Utah-Idaho	125, 000	135, 000	782		200, 000	300, 000	200, 000	108, 525, 000
Central Utah project, Utah, initial phase	107, 478	300, 000	300, 000	300, 000	100, 000	3, 000, 000	15, 000, 000	197, 239, 000
Colorado River storage project:								
Green division:								
Echo Park unit, Colorado-Utah	22, 710	150, 000	100, 000	3, 000, 000	15, 000, 000	30, 000, 000	40, 000, 000	92, 391, 000
Flaming Gorge unit, Utah-Wyoming				75, 000	125, 320	1, 500, 000	15, 000, 000	73, 605, 000
Middle River division, Glen Canyon unit, Arizona-Utah	5, 993	165, 000	135, 000	6, 000, 000	50, 000, 000	54, 000, 000	60, 000, 000	227, 250, 000
San Juan division, Navajo unit, New Mexico-Colorado		50, 000	70, 000	80, 420	700, 000	7, 000, 000	10, 000, 000	50, 940, 000
Florida project, Colorado				60, 000	39, 784	200, 000	2, 000, 000	4, 459, 000
Fruitgrowers Dam project extension, Colorado	6, 132		60, 000	200, 000	800, 000	657, 000		
Gooseberry project, Utah	3, 000	2, 000	1, 468		60, 000	40, 000	200, 000	4, 820, 000
Hammond project, New Mexico						39, 675	100, 000	1, 913, 000
Humboldt project, Nevada	4, 090		60, 000	200, 000	1, 000, 000	1, 200, 000	769, 000	
Lyman project, Wyoming		60, 000	50, 000	39, 600	400, 000	2, 000, 000	3, 000, 000	5, 099, 000
Pine River project extension, Colorado-New Mexico		90, 000	60, 156	300, 000	1, 500, 000	1, 500, 000	941, 000	
Seedskadee project, Wyoming				30, 000	100, 000	20, 416	400, 000	21, 523, 000
Silt project, Colorado				80, 365	300, 000	1, 200, 000	1, 400, 000	444, 000
Smith Fork project, Colorado					80, 083	300, 000	1, 200, 000	1, 759, 000
Washoe project, California-Nevada	227, 000	233, 000	105, 824	220, 000	240, 000	180, 000	600, 000	57, 915, 000
Total, region 4	501, 403	1, 185, 000	943, 230	10, 585, 385	70, 645, 187	103, 137, 091	150, 810, 000	847, 882, 000

See footnotes at end of table.

TABLE 13.—Schedule of public works construction programs—Continued

Name and location of project	Estimated obligations							
	1953	1954	1955	1956	1957	1958	1959	Balance to complete or projects not scheduled
(1-2)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
2. PROJECTS NOT YET AUTHORIZED—continued								
Region 5:								
Canton project, Oklahoma				$100,000	$675,000	$1,500,000	$1,800,000	$411,955
Fort Cobb project, Oklahoma			$150,000	1,115,000	3,499,000	8,238,000	3,496,000	
Foss project, Oklahoma				150,000	1,460,000	3,466,000	8,769,000	7,798,139
Lower Nueces River project, Texas	$7,600	$400,000	526,000	4,190,000	4,190,000	11,000,000	11,900,000	10,257,517
Norman project, Oklahoma			50,000	25,000	350,000	1,650,000	3,000,000	925,000
Nueces River power project, Texas	10,300			900,000	2,000,000	3,000,000	4,030,187	
San Juan-Chama project, Colorado-New Mexico	187,408	377,000	400,000	25,182	600,000	5,081,000	5,084,000	215,855,000
Total, region 5	205,308	777,000	1,126,000	6,505,182	12,774,000	33,935,000	38,079,187	235,247,611
Region 6: None.								
Region 7: Fryingpan-Arkansas project, Colo	32,034	1,022,000	858,000	2,000,000	22,000,000	29,000,000	30,000,000	73,678,218
Total, region 7	32,034	1,022,000	858,000	2,000,000	22,000,000	29,000,000	30,000,000	73,678,218
Alaska District:								
Blue Lake project, Alaska	152,736		1,000,000	6,000,000	4,829,000			
Devil Canyon project, Alaska	24,000	375,000	323,000	184,000	20,000,000	60,000,000	50,000,000	49,094,000
Lake Dorothy project, Alaska	23,106	700,000	3,500,000	9,000,000	2,941,000			
Power Creek project, Alaska		50,000	500,000	3,000,000				
Swan Lake project, Alaska			3,650,000	6,363,000	3,457,854			
Total, Alaska district	199,842	1,125,000	8,973,000	24,547,000	31,227,854	60,000,000	50,000,000	49,094,000
Total, projects not yet authorized	1,893,637	12,118,545	61,438,290	230,645,567	445,537,065	595,156,091	577,557,844	2,639,201,691

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[1] Working fund advances from U. S. Corps of Army Engineers.
[2] Includes $131,000 contribution from Mexico.
[3] Includes $395,000 contribution from Mexico.
[4] Includes $105,092 general investigations funds.
[5] Includes $500,000 reimbursement from flood and storm repairs funds.
[6] Includes $3,000 general investigations funds.
[7] Includes $102,980 reimbursement from flood and storm repairs funds.
[8] Working fund advances from Navy Department.
[9] Includes $75,000 general investigations funds.

[10] Includes $500,000 of funds advanced in fiscal year 1952 for emergency flood and storm repair which will be returned in fiscal year 1953.

[11] Does not include $962,582 of construction and rehabilitation funds appropriated for operation and maintenance activity but programed on operation and maintenance schedules.

[12] Assumes prompt authorization and a supplemental appropriation for construction of the project.

[13] Includes costs for entire Central Arizona project.

TABLE 14.—Schedule of irrigation and power development

Name and location of project	Schedule of power development—Kilowatts (in thousands)									Type	Schedule of irrigation development—Acres (in thousands)								
	Existing 6-30-52	1953	1954	1955	1956	1957	1958	1959	Estimated additional		Existing 6-30-52	1953	1954	1955	1956	1957	1958	1959	Estimated additional
1. AUTHORIZED PROJECTS																			
A. 56 completed projects and divisions	182.4									N	1,973.6								
										S	1,823.0								
B. Continuing divisions or projects:																			
All-American Canal, Ariz.-Calif	24.4	9.6								N	60.6	9.6	4.6						11.3
										S	425.0								
Austin, W. C., Okla										N	47.8								
										S									
Boise-Anderson Ranch, Idaho	27.0									N									
										S	300.0								
Boise-Arrowrock Dam, Idaho										N									
										S									
Boise drainage, Idaho										N									
										S									
Boise-Payette, Idaho										N	52.8								
										S									
Boulder Canyon, Ariz.-Nev	1,167.3	82.5				82.5				N									
										S									
Buffalo Rapids, First division, Mont										N	15.7								
										S									
Buffalo Rapids, Second division, Mont										N	11.6								
										S									
Cachuma, Calif										N			12.5						
										S			14.4						
Central Valley, Calif	454.0			175.5		330.0	20.0			N	9.3	3.0	2.8	4.1	3.2	2.6	37.8	149.9	24.7
										S	533.1	15.3	24.2	41.6	115.3	40.5	26.5	12.3	1.3
Colorado-Big Thompson, Colo	74.7	102.9							6.7	N									
										S	230.0	58.0	122.0	205.0					
Colorado River Front Work and Levee System, Ariz.-Calif.-Nev										N									
										S									
Columbia Basin, Wash	1,974.0									N	73.0	58.0	56.0	63.0	52.0	53.0	49.0	40.0	585.0
										S									
Davis Dam, Ariz.-Nev	225.0									N									
										S									
Deschutes—North unit, Oreg	1.5									N	50.0								
										S	49.2								
Eden, Wyo										N				1.0	5.0	5.0			
										S				2.0	3.0	4.0			

TABLE 14.—Schedule of irrigation and power development—Continued

Name and location of project	Schedule of power development—Kilowatts (in thousands)									Schedule of irrigation development—Acres (in thousands)									
	Existing 6-30-52	1953	1954	1955	1956	1957	1958	1959	Estimated additional	Type	Existing 6-30-52	1953	1954	1955	1956	1957	1958	1959	Estimated additional
1. AUTHORIZED PROJECTS—continued																			
B. Continuing divisions or projects—Con.																			
Eklutna, Alaska			15.0	15.0						N									
										S									
Fort Peck, Mont										N									
										S									
Fort Sumner, New Mex										N	6.5								
										S									
Gila, Ariz										N	20.1	11.8	17.6	29.3		9.0			4.9
										S	1.7	9.9	1.6	2.0					7.1
Hungry Horse, Mont		142.5	142.5							N									
										S									
Kendrick, Wyo	32.4			36.0						N	9.5	1.5	2.0	2.0	2.0	2.0	1.0		
										S									
Kern River, Calif										N									
										S									
Kings River, Calif										N									
										S									
Klamath, Oreg.-Calif										N	84.5			5.9					
										S	124.6		0.7	5.9					34.5
Lewiston Orchards, Idaho										N	3.8								
										S									
Mancos, Colo										N		0.1	0.2	0.4	0.4				
										S	7.4	0.3	0.2						
Milk River, Fresno Dam, Mont										N									
										S									
Minidoka, Gooding, Idaho										N	20.5								
										S	78.2								
Minidoka-North Side pumping, Idaho										N	5.1	2.1	10.0	10.0	10.0	23.6	5.0	3.7	
										S									
Mirage Flats, Nebr										N	12.0								
										S									
Missouri River Basin, various	37.2	15.0	50.0		18.0	10.0	150.0	212.0	584.1	N	9.8	18.2	36.5	23.5	39.2	99.7	74.1	129.4	5,035.2
										S		55.7		4.9	22.5	11.6	42.1	18.0	935.5
Ochoco, Oreg										N									
										S									
Palisades, Idaho-Wyo						85.5	28.5			N									
										S							650.0		
Paonia, Colo										N	1.0				1.2				
										S	11.4	0.9			0.5		2.0		

Pine River, Colo										N						5.6			
										S	42.2								
Provo River, Utah					5.0					N									
										S	46.6	2.0	2.0	2.0	2.0	2.0			
Rehabilitation and betterment: various										N									
										S									
Rio Grande, Elephant Butte power, New Mexico-Texas	24.3									N									
										S									
Riverton, Wyo	1.6									N	62.0		6.0		15.0	15.0			
										S									
San Diego, Calif										N									
										S									
San Luis Valley, Colo									50.0	N									
										S	86.1								271.0
Savage Rapids Dam, Oreg										N									
										S									
Shoshone, Wyo	10.6									N	107.5	1.0							6.5
										S									
Solano, Calif										N				12.0	15.0	29.0			
										S				5.0	11.1				
Sun River, Greenfields, Mont										N	83.0								
										S									
Tucumcari, N. Mex										N	42.2								
										S									
Vermejo, N. Mex										N				7.2					
										S									
Weber Basin, Utah					4.0	1.4				N						5.0	9.0		36.5
										S					2.0	3.0	6.0		13.4
Yakima-Kennewick, Wash					12.0					N					14.5				
										S					4.3				
Yakima-Roza, Wash						10.0				N	72.0								
										S									
Subtotal, continuing divisions or projects	4,054.0	352.5	207.5	226.5	39.0	519.4	198.5	212.0	640.8	N	860.3	105.3	148.2	158.4	157.5	249.5	175.9	323.0	5,704.1
										S	1,935.5	142.1	165.1	256.6	160.7	61.1	726.6	30.3	1,262.8
C. New divisions or projects:																			
Canadian River, Tex										N									20.0
										S									
Carlsbad-Alamogordo Dam, N. Mex										N									
										S									
Collbran, Colo						5.0	2.4			N						2.3			
										S						18.3			
Middle Rio Grande, N. Mex										N									
										S							84.9		
Minidoka-American Falls power, Idaho						30.0				N									
										S									
Subtotal, new divisions or projects						35.0	2.4			N						2.3			20.0
										S						18.3	84.9		
Total, authorized divisions and projects	4,236.4	352.5	207.5	226.5	39.0	554.4	200.9	212.0	640.8	N	2,833.9	105.3	148.2	158.4	157.5	251.8	175.9	323.0	5,724.1
										S	3.758.5	142.1	165.1	256.6	160.7	79.4	811.5	30.3	1,262.8

TABLE 14.—Schedule of irrigation and power development—Continued

Name and location of project	Schedule of power development—Kilowatts (in thousands)									Type	Schedule of irrigation development—Acres (in thousands)								
	Existing 6-30-52	1953	1954	1955	1956	1957	1958	1959	Estimated additional		Existing 6-30-52	1953	1954	1955	1956	1957	1958	1959	Estimated additional
MISSOURI RIVER BASIN																			
Phase A—Units ready for or under construction:																			
Big Horn Basin division, Wyo.:																			
Bluff unit, Wyo										N					1.2				
										S									
Hanover unit, Wyo										N					6.2				
										S									
Owl Creek unit, Wyo										N									
										S				4.4	13.6				
Bostwick division, Nebr.-Kans										N	7.5	2.1	9.6	17.0		28.0	8.5	12.7	4.0
										S									
Boysen division: Boysen unit, Wyo.		15.0								N									
										S									
Cannonball division: Cannonball unit, N. Dak										N								5.0	7.4
										S									
Cheyenne division:																			
Angostura unit, S. Dak	1.2									N		4.0	8.2						
										S									
Keyhole unit, Wyo										N									
										S		55.7							
Rapid Valley unit, S. Dak										N						2.2			
										S					8.9				
Frenchman-Cambridge division, Nebr										N		10.0	12.7	0.3		21.7		3.8	6.5
										S				0.5		11.6		0.5	0.9
Grand division: Shadehill unit, S. Dak										N									12.0
										S									
Heart division:																			
Dickinson unit, N. Dak										N									0.9
										S									
Heart Butte unit, N. Dak										N	0.1		4.0	5.0	4.0				
										S									
Helena-Great Falls division: Canyon Ferry unit, Mont			50.0							N									
										S									
Lower Bighorn division: Yellowtail unit, Mont							150.0	50.0		N									
										S									
Marias division: Lower Marias unit, Mont						2.0			1.6	N						12.0	12.0	12.0	91.0
										S									
Middle Loup division: Sargent unit, Nebr									4.4	N					6.0	7.7			3.8
										S									

Missouri-Souris division:																			
Jamestown unit, N. Dak.										N									10.0
										S									
Missouri diversion unit, Mont.					18.0					N					8.3	3.0	5.5	5.0	87.6
										S									
Montana pumping division:																			
Charley Creek unit, Mont.										N					0.8				
										S									
Nickwall unit, Mont.										N					2.8				
										S									
Moreau division: Bixby unit, S. Dak.										N									11.0
										S									
North Dakota pumping division: Fort Clark unit, N. Dak.										N		2.1							
										S									
Oregon Trail division:																			
Glendo unit, Wyo.								72.0		N									
										S									
Kortes unit, Wyo.	36.0									N									
										S									
Powder division: Moorhead unit, Mont.-Wyo.						8.0				N									
										S									
Smoky-Hill division:																			
Cedar Bluff unit, Kans.										N							11.5		
										S									
Wilson unit, Kans.										N									2.2
										S									
Solomon division:																			
Glen Elder unit, Kans.										N									10.0
										S									
Kirwin unit, Kans.										N					3.4	4.5	3.6		
										S									
Webster unit, Kans.										N									9.0
										S									
South Platte division: Narrows unit, Colo.										N									30.0
										S									230.0
Three Forks division: Crow Creek pump unit, Mont.										N			2.0	1.2	0.4	0.4	1.0		
										S									
Transmission division: Various										N									
										S									
Upper Republican division: St. Francis unit, Colo.-Kans.										N							6.0		
										S							0.5		
Yellowstone division:																			
Cartwright unit, N. Dak.										N									0.8
										S									
Sadie Flat unit, Mont.										N						4.4			
										S									
Savage unit, Mont.										N	2.2								
										S									
Sidney unit, Mont.										N					1.8				
										S									
Subtotal, Phase A	37.2	15.0	50.0		18.0	10.0	150.0	122.0	6.0	N	9.8	18.2	36.5	23.5	34.9	83.9	48.1	38.5	286.2
										S		55.7		4.9	22.5	11.6	0.5	0.5	230.9
Phase B—Units being prepared for construction								60.0	288.0	N					4.3	14.0	11.1	50.8	1,924.2
										S							0.6	6.0	33.4

TABLE 14.—Schedule of irrigation and power development—Continued

Name and location of project	Schedule of power development—Kilowatts (in thousands)									Schedule of irrigation development—Acres (in thousands)									
	Existing 6-30-52	1953	1954	1955	1956	1957	1958	1959	Estimated additional	Type	Existing 6-30-52	1953	1954	1955	1956	1957	1958	1959	Estimated additional
MISSOURI RIVER BASIN—continued																			
Phase C—Continuing work on the general plan of development								30.0	290.1	N						1.8	14.9	40.1	2,824.8
										S							41.0	11.5	671.2
Total, Missouri River Basin	37.2	15.0	50.0		18.0	10.0	150.0	212.0	584.1	N	9.8	18.2	36.5	23.5	39.2	99.7	74.1	129.4	5,035.2
										S		55.7		4.9	22.5	11.6	42.1	18.0	935.5
2. PROJECTS NOT YET AUTHORIZED																			
Region 1:																			
Snake River project, Idaho:																			
Mountain Home division								97.5	90.0	N									192.0
										S									
Hells Canyon division								400.0	400.0	N									
										S									
Crooked River project, Oreg										N								10.2	
										S								9.9	
Upper Star Valley project, Wyo										N									
										S									21.7
The Dalles project, Oreg., Western division.										N									4.5
										S									
Bitterroot Valley project, Mont										N									1.7
										S									48.3
Cambridge Bench project, Idaho										N									
										S									2.4
Council project, Idaho										N									1.6
										S									2.6
Kalispell project, Mont										N								7.7	52.0
										S									
Baker project, Oreg., Upper division										N									
										S							20.0		
Rogue River Basin project, Oreg.:																			
Talent division								10.0		N								11.2	
										S								8.9	
Union Peak division, Cascade Gorge unit							18.0			N									
										S									
Deschutes project, Oreg.: Domestic water system										N									
										S									

Foster Creek project, Wash										N							6.0		
										S							2.7		
Michaud Flats project, Idaho										N							11.0		
										S									
Rathdrum Prairie project, Idaho										N								3.5	32.0
										S									
Columbia Basin project, Wash.: Third powerhouse, Grand Coulee Dam.							216.0	324.0	540.0	N									
										S									
Total, region 1							234.0	831.5	1,030.0	N							17.0	32.6	283.8
										S							22.7	18.8	75.0
Region 2:																			
Divisions and units of Central Valley project (ultimate plan), Calif									380.0	N									228.0
										S									371.0
Santa Maria project, Calif										N									
										S									30.0
Total, region 2									380.0	N									228.0
										S									401.0
Region 3:																			
Central Arizona project, Ariz.-N. Mex									770.0	N									
										S									638.0
Dixie project, Utah								13.2		N							1.0	1.0	5.2
										S							9.0	1.0	
Fort Mohave project, Nev										N					1.5	1.0			
										S									
Marble Canyon project, Ariz									350.0	N									
										S									
Total, region 3								13.2	1,120.0	N					1.5	1.0	1.0	1.0	5.2
										S							9.0	1.0	638.0
Region 4:																			
Bear River project, Utah-Idaho										N									116.2
										S									72.8
Central Utah project, Utah (initial phase)									61.0	N									28.6
										S									131.8
Colorado River storage project:																			
Green division:																			
Echo Park unit, Colo.-Utah									200.0	N									
										S									
Flaming Gorge unit, Utah-Wyo									72.0	N									
										S									
Middle River division: Glen Canyon unit, Ariz.-Utah									800.0	N									
										S									
San Juan division: Navajo unit, N. Mex.-Colo									30.0	N									
										S									
Florida project, Colo										N									6.3
										S									12.7
Fruitgrowers Dam project extension, Colo										N								0.5	
										S								3.0	

TABLE 14.—Schedule of irrigation and power development—Continued

Name and location of project	Schedule of power development—Kilowatts (in thousands)									Schedule of irrigation development—Acres (in thousands)									
	Existing 6-30-52	1953	1954	1955	1956	1957	1958	1959	Estimated additional	Type	Existing 6-30-52	1953	1954	1955	1956	1957	1958	1959	Estimated additional
2. PROJECTS NOT YET AUTHORIZED—con.																			
Region 4—Continued																			
Gooseberry project, Utah										N									
										S									17.4
Hammond project, N. Mex										N									3.7
										S									
Humboldt project, Nev										N									10.0
										S									30.0
Lyman project, Wyo										N									
										S									40.6
Pine River project extension, Colo.-N. Mexico										N									15.2
										S									
Seedskadee project, Wyo										N									60.7
										S									
Silt project, Colo										N									1.8
										S									5.0
Smith Fork project, Colo										N									2.2
										S									8.2
Washoe project, Calif.-Nev										N									15.0
										S									40.0
Total, region 4									1,163.0	N								0.5	259.7
										S								3.0	358.5
Region 5:																			
Canton project, Okla										N								16.0	
										S									
Fort Cobb project, Okla										N								9.0	
										S									
Foss project, Okla										N									16.7
										S									
Lower Nueces River project, Tex										N									
										S									
Norman project, Okla										N									1.5
										S									
Nueces River power project, Tex								25.0		N									
										S									

San Juan-Chama project, Colo.-New Mex.									145.0	N									
										S									75.0
Total, region 5								25.0	145.0	N								25.0	18.2
										S									75.0
Region 6: (None).																			
Region 7: Fryingpan-Arkansas project, Colo.									104.8	N									
										S									322.0
Total, region 7									104.8	N									
										S									322.0
Alaska district:																			
Blue Lake project, Alaska						15.0				N									
										S									
Devil Canyon project, Alaska									450.0	N									
										S									
Lake Dorothy project, Alaska						30.0				N									
										S									
Power Creek project, Alaska					5.0					N									
										S									
Swan Lake project, Alaska						13.5				N									
										S									
Total, Alaska district					5.0	58.5			450.0	N									
										S									
Total, projects not yet authorized					5.0	58.5	234.0	869.7	4,392.8	N					1.5	1.0	18.0	59.1	794.9
										S							31.7	22.8	1,869.5

NOTE.—N=Full irrigation supply. S=Supplemental irrigation supply.

Appropriations

The Bureau of Reclamation's regular and supplemental appropriations for fiscal year 1952 amounted to $234,408,522, a decrease of $37,135,478 under fiscal year 1951. With the unobligated balance of $34,145,355 from the previous year, the money available for Reclamation totaled $268,553,877.

The unobligated funds at the end of fiscal year 1952 totaled $49.5 million. This unobligated balance resulted principally from the shortage of materials needed for the construction of power facilities and unanticipated delays in executing repayment contracts of which some are pending validation by the courts.

Another factor having a bearing on the unobligated balance was the limitation on the amount that could be expended for personal services which was placed on each of the four main appropriations of the Bureau.

Obligations for fiscal year 1952 totaled $217.6 million or 86.5 percent of the obligations programmed in 1952, as compared with 90.4 percent of the obligation program accomplished in fiscal year 1951.

In addition to the personal services limitation previously mentioned, the 1952 Appropriation Act imposed certain other restrictions on the Bureau, one of which prohibited the initiation of construction of transmission facilities in areas covered by power wheeling contracts unless the power company in such an area was unable or unwilling to construct them.

The limitation on the amount of money which may be used for performance of work by Government forces (force account work), first imposed upon the Bureau in 1949 Appropriation Act, was included again in the 1952 Appropriation Act. The 1952 act carried the same limitation as appeared in the 1951 and 1950 Appropriation Acts, viz, not to exceed 12 percent of the allotment for any one project with a maximum of $225,000 to be used on any one project or unit of Missouri River Basin.

A limitation of $150,000 in the general administrative expenses appropriation was imposed upon expenditures for information work in 1952. This is the same limitation as appeared in the 1951 and 1950 acts.

The amount appropriated, including all supplementals for fiscal year 1952 for each activity, together with the amount to be derived from the special and general funds, was as follows:

TABLE 15.—Condensed statement of appropriations, fiscal year 1952, exclusive of trust funds

	Amount appropriated
General investigations	$4,500,000
Reclamation fund	(3,810,000)
Colorado River Dam fund: Colorado River development fund	(500,000)
General fund	(190,000)
Construction and rehabilitation	208,052,725
Reclamation fund	(29,257,650)
General fund	(178,795,075)
Operation and maintenance	15,977,594
Reclamation fund	(12,476,944)
Colorado River Dam fund	(1,671,000)
General fund	(1,829,650)
General administrative expenses	5,478,203
Reclamation fund	(5,478,203)
Emergency fund	400,000
Reclamation fund	(400,000)
Grand total	234,408,522
Reclamation fund	(51,422,797)
Colorado River Dam fund	(2,171,000)
General fund	(180,814,725)

Reports

During fiscal year 1952, collection and compilation of the Bureau's basic statistical data on allotments and appropriations from 1902 through 1952, by projects and activities, by years, by funds, by functions and by States was practically completed, together with pertinent data on investments, costs, revenues, funds, and related items. This information has been assembled for publication in 1953 in the form of a statistical appendix to the Secretary's annual report for administrative use.

Refinements were incorporated in the Bureau's basic summary cost and progress report including the establishment of "total cost" common base relating programs to accounts and reporting thereon. Monthly reporting on year-end estimates of unobligated funds was supplemented with monthly reporting of year-end estimates of unliquidated obligations; the combination of both representing estimates of year-end unexpended funds for budget and programing purposes.

In addition to providing for all official reports on employment, a system was installed for carrying out the Jensen and Ferguson amendments of the 1952 Appropriation Act which placed limitations on personnel and personal services. From July 1, 1951, to June 30, 1952, total employment dropped from 16,836 to 14,037. Upon expiration of these limitations at the year-end, the Commissioner's personnel ceiling was reinstated for fiscal year 1953 to serve the same purposes in a more practical manner. The personnel roster which lists all personnel of the Bureau by name, title, grade and salary was coded to show function, post of duty, and organizational unit of each employee for use in conjunction with both the Commissioner's personnel ceiling and the administrative and general expenses reports.

Program Briefs, a monthly summary of narrative high-light comments on construction accomplishments by projects and MRB units, was introduced in 1952 to keep top officials promptly informed on conditions, particularly where their assistance is required, and will be expanded in 1953 to include all other Reclamation activities.

Processing of the administrative and general expenses reports was undertaken in late 1952. These reports, which replace the activity and object expenditures report in effect 1950 through 1952, provide management with adequate monthly information or organization, positions, employment, personal services, and other expenditures. Coupled with the coded personnel roster, these reports will be used for improving the efficiency of Bureau operations during 1953.

The Washington Report, a biweekly periodical on newsworthy items and Bureau policies as expressed at the Commissioner's staff conferences, met its schedule in 1952 and will be continued in 1953; the monthly Programs and Finance Division report likewise. Federal Power Commission FPC No. 1 reports on power projects were filed in accordance with instructions. For 1953 these (1952) reports will be prepared to conform to the Bureau's accounting system, currently reflecting multipurpose plant and will be limited essentially to power data details. The consolidated operating statement of Bureau of Reclamation power system is scheduled for publication early in 1953 covering fiscal year 1952.

A specaial publication program for 1953 was undertaken in late 1952 consisting of printed supplements to Bureau of Reclamation Appropriation Acts and Allotments and Bureau of Reclamation Project Feasibilities and Authorizations; a new edition of How Reclamation Pays; a revised edition of The Reclamation Program (for 1953–59), and the Statistical Appendix. In each instance published data will be up to date of June 30, 1952.

Serving as a center for clearing statistical data, various releases of the Bureau were checked and data compiled for numerous inquiries of Members of the Congress and to meet requests of other agencies and the public for information.

TABLE 16.—Appropriations from Reclamation and other funds, fiscal years 1902–1952

Fiscal year	Reclamation fund		General fund		Colorado River dam fund	Emergency relief funds [2]	Permanent appropriations	Total
	Regular [1]	Power revenue	Regular	Colorado River FW and LS				
1902	[3] $165,000							([3])
1903	[3] 5,950,000							([3])
1904	[3] 18,440,000							[3] $2,000,000
1905	[3] 8,758,000							([3])
1906	[3] 27,494,961							[3] 15,363,800
1907	[3][4] 43,569,161							([3])
1907	[3] 18,176,161							[3] 18,051,161
1908	9,562,038							9,562,038
1909	9,180,700							9,180,700
1910	8,183,300							8,183,300
1911	26,896,790							26,896,790
1912	8,262,367							8,262,367
1913	8,300,508							8,300,508
1914	15,931,922							15,931,922
1915	1,261,411							1,261,411
1916	13,530,000							13,530,000
1917	8,887,557		$15,000					8,902,557
1918	8,227,000		310,213					8,537,213
1919	9,397,081		443,196					9,840,277
1920	7,300,000		548,927					7,848,927
1921	8,463,000		661,177					9,124,177
1922	20,266,000		335,871					20,601,871
1923	14,800,000		559,530					15,359,530
1924	13,800,000		314,067					14,114,067
1925	11,890,809							11,890,809
1926	12,563,240			$50,000				12,613,240
1927	7,436,320		40,000	35,000				7,511,320
1928	12,148,800		15,000	35,000				12,198,800
1929	14,138,400	$190,000	15,000	100,000				14,443,400
1930	8,253,000	390,000	10,660,000	100,000				19,403,000
1931	9,087,000	395,000		100,000				9,582,000
1932	6,971,000	300,000	25,000,000	100,000				32,371,000
1933	2,442,288	375,000	13,050,000					15,867,288
1934	3,003,000	405,000	8,000,000	48,000		$103,535,000		114,991,000
1935	860,750	316,000				34,076,000		35,252,750
1936	1,022,100	366,000	15,900,000	50,000		25 438,000		42,776,100
1937	12,028,600	316,000	34,850,000		$350,000	[4] 4,873,000		42,671,600
1938	11,991,600	331,000	30,655,000	15,000	500,000	37,047,500	$1,100,000	81,640,100
1939	10,574,600	366,000	32,980,000	15,000	500,000	[4] 2,502,488	4,600,000	46,533,112
1940	13,269,600	606,000	64,200,000	15,000	575,000	28,347	5,700,000	84,393,947
1941	9,429,600	571,000	63,750,000	15,000	768,000	[4] 124,300	6,600,000	81,009,300
1942	7,446,600	664,400	94,245,031	50,000	1,000,000	[4] 19,961	2,600,000	105,986,070
1943	2,651,060	956,900	86,628,565	47,895	1,379,250	[4] 1,131	2,600,000	94,262,539
1944	2,422,500	2,091,975	35,578,000	75,000	1,443,100	[4] 72,709	5,669,468	47,207,334
1945	5,321,000	2,328,800	17,734,200	340,000	2,200,000	[4] 22,332	5,282,501	33,184,169
1946	34,089,290	2,528.600	82,858,000	612,500	2,550,000		4,491,718	127,130,108
1947	36,315,968	3,284,245	75,931,805	100,000	1,814,330	[4] 30,396	4,806,879	122,222,831
1948	20,127,250	5,549,500	115,420,288		2,088,000		5,545,400	148,730,438
1949	29,952,663	6,999,601	226,801,503		2,450,000		4.693,475	270,897,242
1950	35,447,705	9,327,097	311,434,175		2,123,100		8,034,825	366,366,902
1951	46,917,365		222,453,635		2,308,000		5,650,514	277,329,514
1952	51,422,347		180,665,175		2,171,000		6,505,000	240,763,522
Total	646,839,090	38,658,118	1,752.053,353	903,395	24,219,780	192,478,530	73,879,780	2,730,082,051

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[1] Prior to fiscal year 1916 funds were made available from the Reclamation fund by allotment authorized by the Secretary of the Interior.

[2] Emergency relief funds include allocations from NIRA, PWA, and ERA funds.

[3] Allotments made prior to Fallon, Nev., conference on July 27, 1907, were canceled and summary allotments issued. Original amounts excluded from total column.

[4] Credit.

TABLE 17.—The Reclamation fund, 1951–53, funds available for appropriation

	Actual 1951	Actual 1952	Estimated 1953
Unappropriated balance brought forward (as of June 30)	$32, 136, 457	$40, 828, 300	$74, 719, 171
Accretions and collections:			
Bureau of Reclamation, .100	8, 893, 499	11, 322, 621	
Other agencies, .200	17, 929, 996	22, 952, 820	
Reclamation fund, power revenues, .300	29, 417, 040	43, 453, 149	
Total accretions and collections	56, 240, 535	77, 728, 590	
Total available for appropriation	88, 376, 992	118, 556, 890	
Less:			
Appropriated for refund of revenue collections	398, 154	150, 000	
Appropriated for Farmers irrigation district, North Platte project, Nebraska	6, 575	10, 088	
Add:			
Lapsed appropriations	2, 309, 137	5, 208, 981	
Return of F. Y. 1951 appropriations, sec. 1214		2, 535, 735	
Deduct appropriation or estimate for—			
General investigations	5, 116, 000	3, 810, 000	
Construction and rehabilitation	25, 135, 700	29, 257, 650	
Operation and maintenance	12, 001, 400	12, 476, 494	
General administrative expenses	7, 200, 000	5, 478, 203	
Emergency fund		400, 000	
Total appropriation or estimate	49, 453, 100	51, 422, 347	
Balance carried forward	40, 828, 300	74, 719, 171	

TABLE 18.—Accretions to Reclamation fund by States, fiscal year 1952

State	Sale of public land		Proceeds from Oil Leasing Act		Total to June 30, 1952
	Fiscal year 1952	To June 30, 1952	Fiscal year 1952	To June 30, 1952	
Alabama		$4, 372. 65	$1, 881. 07	$200, 973. 42	$205, 346. 07
Arizona	$19, 099. 93	2, 898, 985. 62	59, 784. 44	135, 348. 46	3, 034, 334. 08
Arkansas			216. 30	2, 999. 38	2, 999. 38
California	416, 918. 89	9, 257, 951. 19	4, 053, 138. 07	47, 286, 639. 65	56, 544, 590. 84
Colorado	88, 580. 08	10, 640, 358. 69	3, 156, 044. 14	13, 273, 939. 30	23, 914, 297. 99
Florida			15. 75	141. 75	141. 75
Idaho	113, 483. 13	7, 408, 029. 29	59, 699. 11	306, 338. 98	7, 714, 368. 27
Illinois			10. 50	31. 50	31. 50
Kansas	26. 78	1, 039, 932. 91	57, 603. 69	211, 093. 06	1, 251, 025. 97
Louisiana			22, 323. 17	446, 940. 17	446, 940. 17
Michigan			950. 01	12, 045. 99	12, 045. 99
Mississippi			924. 65	4, 573. 75	4, 573. 75
Montana	72, 465. 93	15, 694, 931. 66	801, 281. 72	5, 963, 685. 91	21, 658, 617. 57
Nebraska	1, 994. 70	2, 158, 545. 64	1, 025. 06	7, 833. 86	2, 166, 379. 50
Nevada	11, 908. 22	1, 117, 828. 04	249, 522. 90	703, 785. 23	1, 821, 613. 27
New Mexico	38, 222. 56	6, 957, 440. 46	3, 119, 319. 39	18, 963, 715. 08	25, 921, 155. 54
North Dakota	16, 410. 45	12, 262, 399. 99	60, 153. 23	462, 954. 93	12, 725, 354. 92
Oklahoma	9, 929. 69	5, 961, 000. 91	29, 240. 08	118, 608. 67	6, 079, 609. 58
Oregon	600, 345. 72	13, 195, 111. 41	7, 547. 62	18, 098. 08	13, 213, 209. 49
South Dakota	6, 150. 70	7, 753, 219. 75	16, 189. 00	113, 863. 28	7, 867, 083. 03
Utah	50, 712. 95	4, 590, 957. 09	1, 437, 966. 28	4, 981, 002. 06	9, 571, 959. 15
Washington	183, 915. 93	8, 058, 289. 27	1, 176. 30	51, 603. 66	8, 109, 892. 93
Wyoming	35, 540. 81	9, 144, 315. 02	6, 952, 767. 24	74, 752, 613. 85	83, 896. 928. 87
Total	1, 665, 706. 47	118, 143, 669. 59	20, 088, 779. 72	168, 018, 830. 02	286, 162, 499. 61
Proceeds, Federal water-power licenses					[1] 1, 282, 714. 92
Proceeds, potassium royalties and rentals					[2] 5, 585, 762. 16
Receipts from Naval petroleum reserves, 1920–38, act of May 9, 1938					29, 778, 300. 23
Proceeds from rights-of-way over withdrawn lands, act of July 19, 1919					[3] 10, 978. 25
Lease of lands					[4] 51, 898. 02
Town lot sales					[5] 724, 645. 77
Timber sales and other miscellaneous items					[6] 191, 223. 33
Grand total					323, 788, 022. 29

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[1] Proceeds for fiscal year	$116, 817. 42
[2] Proceeds for fiscal year	1, 027, 542. 16
[3] Proceeds for fiscal year	427. 61
[4] Proceeds for fiscal year	19, 917. 63
[5] Proceeds for fiscal year	1, 100. 04
[6] Proceeds for fiscal year	32, 528. 60
Total	1, 198, 333. 46

TABLE 19.—Cost of plant, property and equipment as of June 30, 1952

State or territory	Project	Completed works					Construction in progress	Other physical property	Total
		Multi-purpose (1)	Irrigation (2)	Electric (3)	Municipal water (4)	Flood control (5)	(6)	(7)	(8)
Alaska	Eklutna						$5, 952, 526		$5, 952, 526
Arizona	Gila		$14, 409, 906				11, 790, 365		26, 200, 271
	Salt River	$5, 224, 890	10, 753, 356	$4, 266, 443			2, 590, 918		22, 835, 607
	Boulder Canyon:								
California-Arizona	All-American Canal system		52, 889, 534			$4, 548, 000	788, 716	$392, 522	58, 618, 772
Nevada-Arizona	Hoover Dam and power plant	94, 607, 532		51, 162, 800			14, 165, 112	5, 985, 583	165, 921, 027
Arizona-California-Nevada.	Colorado River front work and levee system.					6, 589, 488	2, 030, 329		8, 619, 817
	Davis Dam	35, 028, 479		68, 213, 088			4, 521, 671		107, 763, 238
Arizona-California	Parker Dam power	7, 538, 785		16, 394, 234			268, 789		24, 201, 808
	Yuma:								
	Regular		5, 362, 143	414, 194			30, 406		5, 806, 743
	Auxiliary		2, 266, 487						2, 266, 487
California	Cachuma	2, 097, 967					17, 068, 583		19, 166, 550
	Central Valley	210, 748, 077	58, 693, 870	67, 415, 832			30, 074, 301	2, 965, 251	369, 897, 331
	Orland		2, 564, 519						2, 564, 519
	San Diego				$269, 485		4, 217		273, 702
Colorado	Colorado-Big Thompson	69, 107, 557	2, 119, 325	22, 112, 518			30, 179, 359		123, 518, 759
	Fruitgrowers Dam		200, 309						200, 309
	Grand Valley		5, 420, 325	213, 669			260, 214		5, 894, 208
	Mancos		3, 840, 601				23, 166		3, 863, 767
	Paonia		1, 421, 425				23, 968		1, 445, 393
	Pine River		3, 421, 436					21, 442	3, 442, 878
	San Luis Valley						4, 736, 399		4, 736, 399
	Uncompahgre		5, 969, 586						5, 969, 586
Idaho-Oregon	Boise	27, 610, 868	29, 488, 198	6, 241, 751			254, 684		63, 595, 501
Idaho	Preston Bench		449, 554						449, 554
	Rathdrum Prairie:								
	Hayden Lake		118, 409						118, 409
	Post Falls		363, 951						363, 951
	Lewiston Orchards	426, 999	1, 028, 014		990, 793		33, 896		2, 479, 702
Idaho-Wyoming	Minidoka	845, 403	20, 636, 482	2, 897, 674			208, 176		24, 587, 735
	Palisades						3, 638, 964		3, 638, 964
Montana	Bitter Root		955, 051				32, 809		987, 860
	Bitterroot Valley-Woodside						88, 703		88, 703
	Buffalo Rapids:								
	First Division		2, 030, 399				154, 858		2, 185, 257
	Second Division		2, 090, 505				198, 365		2, 288, 870
	Frenchtown		290, 797						290, 797
	Hungry Horse						87, 686, 483		87, 686, 483

TABLE 19.—Cost of plant, property and equipment as of June 30, 1952—Continued

State or territory	Project	Completed works					Construction in progress	Other physical property	Total
		Multipurpose	Irrigation	Electric	Municipal water	Flood control			
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Montana	Huntley		$1, 552, 159						$1, 552, 159
	Intake		92, 371						92, 371
	Milk River		8, 947, 860				$211, 984		9, 159, 844
	Missoula Valley		278, 762						278, 762
	Sun River		9, 888, 906				35, 796		9, 924, 702
Montana-North Dakota	Fort Peck			$8, 670, 334			895, 899		9, 566, 233
	Lower Yellowstone		3, 633, 219						3, 633, 219
Nebraska	Mirage Flats		3, 222, 588						3, 222, 588
Nebraska-Wyoming	North Platte	$3, 232, 672	14, 893, 865	1, 442, 560			1, 390, 235		20, 959, 332
Nevada	Humboldt		1, 214, 321						1, 214, 321
	Newlands		3, 117, 316	344, 343					3, 461, 659
Nevada-California	Truckee storage		1, 092, 423						1, 092, 423
New Mexico	Carlsbad		4, 061, 846				837		4, 062, 683
	Fort Sumner		2, 424, 200					$5, 050	2, 429, 250
	Hondo		371, 788						371, 788
	Middle Rio Grande						840, 684		840, 684
	Tucumcari		15, 090, 204				17, 207		15, 107, 411
	Vermejo						31, 419		31, 419
New Mexico-Texas	Rio Grande	8, 331, 092	10, 680, 440	6, 529, 455			329, 944		25, 870, 931
	Rio Grande River rectification		180, 628						180, 628
North Dakota	Buford-Trenton (old)		1, 999						1, 999
	Buford-Trenton (W. C. U.)		1, 238, 546						1, 238, 546
Oklahoma	W. C. Austin		11, 953, 115				309, 215		12, 262, 330
Oregon	Arnold		205, 535						205, 535
	Baker		281, 589						281, 589
	Burnt River		601, 026						601, 026
	Deschutes-North Unit		11, 058, 915	515, 304			437, 779		12, 011, 998
	Grants Pass		100, 000						100, 000
	Ochoco		848, 830						848, 830
	Umatilla		4, 411, 116						4, 411, 116
	Vale		4, 857, 670				105, 027		4, 962, 697
Oregon-California	Klamath		11, 306, 922				2, 350, 054	12, 066	13, 669, 042
Oregon-Idaho	Owyhee		18, 998, 744						18, 998, 744
South Dakota	Belle Fourche		4, 638, 236				350, 821		4, 989, 057
	Rapid Valley	927, 062						350	927, 412
Texas	Balmorhea		429, 554						429, 554
	Colorado River	23, 496, 993		464, 801					23, 961, 794
Utah	Hyrum		953, 854						953, 854
	Moon Lake		1, 599, 359						1, 599, 359
	Newton		712, 591						712, 591

	Ogden River		4, 735, 284						4, 735, 284
	Provo River	5, 121, 983	3, 585, 684		$12, 787, 627		8, 077, 276		29, 572, 570
	Sanpete		374, 540						374, 540
	Scofield		943, 889						943, 889
	Strawberry Valley		3, 345, 939	91, 969				61, 086	3, 498, 994
	Weber River		2, 725, 885						2, 725, 885
Washington	Columbia Basin	157, 618, 569	3, 374, 573	108, 763, 626			156, 884, 507	3, 605, 293	430, 246, 568
	Okanogan		500, 084	5, 736			6, 271		512, 091
	Yakima		44, 142, 029	600, 844			701, 662		45, 444, 535
Wyoming	Eden						2, 376, 054		2, 376, 054
	Kendrick	5, 081, 774	9, 021, 178	6, 834, 770			2, 117, 903		23, 055, 625
	Riverton	2, 814, 687	13, 256, 075	423, 298			2, 731, 066		19, 225, 126
Wyoming-Montana	Shoshone	1, 867, 285	14, 130, 013	3, 506, 894			998, 855		20, 503, 047
Various	Missouri River Basin	80, 548, 113	10, 219, 839	30, 321, 541			85, 346, 119	347, 727	206, 783, 343
	Soil and moisture conservation						5, 761	46, 139	51, 900
	Other physical property							4, 092, 479	4, 092, 479
Total		742, 276, 788	492, 079, 694	407, 847, 676	14, 047, 905	$11, 137, 488	483, 358, 354	17, 534, 988	[1] 2, 168, 282, 893

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[1] Excludes $6,350,856 of investigation and other costs not distributed to features.

COMPTROLLER

The Office of Comptroller has effectively discharged its delegated functions for unbiased evaluation of the financial affairs of the Bureau. For the fiscal year 1952 the Comptroller has completed more assignments, rendered more reports, and covered a greater diversity of financial review than in any year since the office was founded. The audit performance has been consistently such as to elicit expressions of confidence and commendation from those in a position to make a professional appraisal.

A total of 88 reports were issued by the Comptroller covering (1) comprehensive project audits, (2) varied special audits dealing with selective segments of the project accounts and operations, (3) water users' organizations, (4) surveys to ascertain compliance with prior audit and survey findings, and (5) review of data requisite for amendatory repayment contract negotiations.

During the year the comprehensive surveys by the Division of Audits of the General Accounting Office have been expanded to provide total Bureau coverage. In order to eliminate to the greatest extent practicable the tendencies of overlap as between our audit staff and that of General Accounting Office and to effect greater efficiency otherwise, the Office of Comptroller has a plan in the development stage, the design of which proposes to provide:

1. The maximum precaution with respect to overlapping of assignments;
2. Audit coverage in more detail and with greater currency;
3. Insure remedial action on internal disclosures; and,
4. The improvement of the reporting system to afford more effective presentation to top management, and to insure more frequent and rapid reporting.

In addition to the audit activity the Office of Comptroller continued to discharge its functions of financial policy and review in matters of repayment contracts, analyses of rate schedules, municipal finance and management, interagency agreements, external audit and investigational reports and legislation.

In summary, the Comptroller has effectively operated its small staff to insure adequate and comprehensive audit coverage of Bureau projects and ably discharged his function as financial adviser of the Bureau.

LEGISLATION

The fiscal year 1952 can record but few enactments by the Congress of bills to carry forward the Reclamation program. No Reclamation projects were authorized for construction by the Congress during the year.

Two river compacts negotiated by the various affected States were consented to by the Congress. The consent of the Congress to the Yellowstone River Compact among the States of Montana, North Dakota, and Wyoming was granted by the act of October 30, 1951 (Public Law 231, 82d Cong.). In connection with the plan of this Department for improvements in the Yellowstone River Basin, as set forth in our Missouri River Basin plan, it is believed that the Yellowstone River Compact is an important step toward the harmonious realization of the contemplated developments. The second compact concerns the waters of the Canadian River and was negotiated by the States of Oklahoma, Texas, and New Mexico. The consent of the Congress to this compact was necessary before construction may be initiated on the proposed Canadian River project, Texas.

The act of March 6, 1952 (Public Law 273, 82d Cong.), is of importance to the Bureau of Reclamation in connection with the orderly administration of the amendatory repayment contract program. That act continues until December 31, 1954, the authority of the Secretary to negotiate with water users' organizations amendments to repayment contracts and other form of obligations which had been entered into prior to August 4, 1939. Also, it continues until that time the authority of the Secretary to grant deferments of construction charges in certain circumstances.

During the fiscal year five more amendatory repayment contracts, negotiated pursuant to section 7 of the Reclamation Project Act of 1939, were authorized by the Congress to be signed by the Secretary. The contracts authorized to be executed by the Secretary on behalf of the United States by the act of June 23, 1952 (Public Law 402, 82d Cong.), concerned water users on the Owyhee, Riverton, Milk River, and Frenchtown Federal reclamation projects.

The act of March 5, 1952 (Public Law 269, 82d Cong.), removed the requirement in section 3 of the act of September 27, 1950 (64 Stat. 1072), that the organization contracting with the United States for the return of the reimbursable cost of the Vermejo project have the power to tax personal property. However, the organization must have the power to tax real property.

Notwithstanding the recommendations of the Department of the Interior, the Congress, by the act of June 27, 1952, removed the application of the excess-land provisions of the Federal reclamation laws to certain lands in the San Luis Valley project, Colorado.

At the close of the fiscal year the following bills were in the final stages of enactment by the Congress or were before the President for his approval:

H. R. 2813: To authorize the Secretary of the Interior to construct, operate, and maintain the Collbran Reclamation project, Colorado.

H. R. 6578: To provide for research into and development of practical means for the economical production, from sea or other saline waters, of water suitable for agricultural, industrial, municipal, and other beneficial consumptive uses.

H. R. 6163: To provide for authorization of a study and report of irrigation works in connection with Chief Joseph Dam.

H. R. 6723: To authorize the execution of certain amendatory repayment contracts negotiated pursuant to section 7 of the Reclamation Project Act of 1939.

S. 3333: To authorize the acquisition of certain lands of the Shoshone and Arapaho Indian Tribes of the Wind River Reservation needed for the construction and operation and maintenance of the Boysen unit of the Missouri River Basin project.

Litigation

Work in connection with litigation affecting the Bureau of Reclamation appeared to reach an all-time high during the fiscal year 1952. Attorneys of the Bureau participated in such litigation, as amici curiae, by filing briefs and making oral argument, and by assisting attorneys of the Department of Justice in the conduct of trials and in the preparation and review of legal briefs, arguments, and stipulations.

The following actions pending before various courts at the close of the fiscal year 1951 were brought to a conclusion during the fiscal year 1952:

1. In connection with the action *Will Gill* v. *The United States*, and three related cases in the Court of Claims, a settlement was approved by all the parties and judgment was entered providing for payment of approximately $195,900 to the plaintiffs. These actions involved water rights of owners of land located along the San Joaquin River between Gravelly Ford and Mendota Pool, Central Valley project, California.

2. Judgments were entered in accordance with a stipulation in the action *W. F. Brush* v. *The United States*, and sixteen related cases, in the Court of Claims. These actions involved the water rights of owners along the San Joaquin River below the mouth of the Merced River, Central Valley project, California. The sum of the judgment plus interest amounted to approximately $250,000.

3. In regard to the attempt on the part of the objectors to obtain an injunction restraining the Board of Directors of the Kansas Bostwick Irrigation District for proceeding with the confirmation proceeding of its repayment contract with the United States, the Kansas Supreme Court handed down a decision to the effect that the contract

should be confirmed. After confirmation of the contract by the lower court, the parties opposing the confirmation served notice of an appeal to the United States Supreme Court. That court denied the appeal on the grounds that no Federal question was involved.

Actions pending before judicial tribunals at the close of the fiscal year 1951, but which were not concluded during the fiscal year 1952, include the following:

1. *Everett G. Rank* v. *Julius A. Krug*, No. 685–ND, United States District Court for the Southern District of California. This is a purported class action filed in 1947 to enjoin certain named Federal officials in the operation of Friant Dam and Reservoir, Central Valley project, California. During the early part of the fiscal year 1952, the plaintiffs filed an amended complaint and a motion for a preliminary injunction which, if granted, would have required the defendants to make substantial release of water from Friant Dam down the San Joaquin River and would have seriously interfered with the operation of the project Hearings on this motion were held in Fresno, Calif. On August 4, with the consent of defendants, a temporary restraining order was made by the court providing for the release of 2,000 cubic feet per second of water from Friant Dam until certain channelization and pump rectification work was accomplished by the defendants. This work was immediately undertaken, and reduction in releases were made. Further hearings were held and a new order was made by the court allowing further reductions in the amount of water released on condition that certain specified work be performed along the 37 miles of river below Friant Dam. The court also ordered that proposed plans for a physical solution be submitted by the parties and that the merits of the case would be tried on January 19, 1952. Pretrial hearings were held and proposed plans were submitted by the plaintiffs, the State of California, and the Bureau. The trial was reset to begin on January 29, 1952. The trial has been in session since that date and has continued into the fiscal year 1953.

2. *Hollister Land and Cattle Co.* v. *Krug*, No. 680–ND, United States District Court for the Southern District of California, is an action brought by a purported class composed of all owners of land within the boundaries of the Grass Lands Water Association, an area of approximately 106,000 acres lying below Mendota Pool. A motion for a preliminary injunction was filed July 27, 1951, coincident with a similar motion in *Rank* v. *Krug.*. Hearings on this motion were held in Fresno concurrent with the *Rank* v. *Krug* hearings. On August 29, in court, the Bureau offered the plaintiffs a contract for delivery of project water under which the plaintiffs would ultimately pay only for that water to which they were not legally entitled.

Because of this offer the court refused to issue any temporary injunction and set the case for hearing on the merits at the same time as *Rank* v. *Krug*. This offer was not accepted by the plaintiffs. A pretrial hearing was held on December 20, 1952, and the court entered an order that further hearings in this case would not be held until the hearing on the merits in *Rank* v. *Krug* was concluded.

3. Also pending in the United States District Court for the Southern District of California are 11 inverse condemnation proceedings brought by owners of land in the Friant to Gravelly Ford area. These cases are numbered 670–ND to 679–ND and 682–ND. The plaintiffs are members of the purported class action in *Rank* v. *Krug*, and the cases have been taken off the calendar until that case is concluded.

4. *Pacific Gas and Electric Company* v. *United States*, No. 47972, filed in the Court of Claims, involves claims of the plaintiff company for a taking of a proposed steam-plant site in the Friant to Gravelly Ford area. It is anticipated that hearings will be held before a commissioner in the near future.

5. *Cotton Land Company et al.* v. *United States*, No. 46422, filed in the United States Court of Claims in April 1945, was an action seeking to recover $890,596 for alleged flood damages to plaintiff's lands as a result of the construction and operation of Parker Dam, Parker Dam project. Following the court's decision of January 5, 1948, holding the Government liable, and the court commissioner's supplemental report filed May 29, 1951, plaintiff's attorneys submitted an offer of compromise settlement on July 30, 1951, which was under consideration during the balance of that year. Negotiations resulted in the filing of a stipulation for judgment and contract of settlement, in which plaintiffs agreed to convey to the United States approximately 1,675 acres of land, and to accept $82,264.33, plus interest at 4 percent per annum from December 15, 1951, in full settlement of all their claims, of which amount the Metropolitan water district of southern California agreed to pay 60 percent. Judgment pursuant to the stipulation was entered in February 1952.

6. A report of the special master, and proposed finding of fact, conclusions of law, and decree were filed in the case of the *United States* v. *Alpine Land & Reservoir Company*, pending in the District Court of the United States for the District of Nevada. This suit was instituted to determine the priority and extent of water rights of the United States acquired for the Newlands project on the Carson River, California and Nevada. Motions have been filed by various litigants to reopen the case for the taking of additional testimony and for intervention. An effort is being made to stipulate a decree, and the court has granted extensions of time for the filing of

objections to the proposed findings of fact, conclusions of law, and decree pending negotiations for a settlement.

7. The action *United States* v. *Sierra Valley Water Company* was filed in the District Court of the United States for the Northern District of California, northern division, to enjoin excessive diversions of water of the Little Truckee River in violation of the water rights of the United States acquired for the Newlands project, Nevada. The case is at issue and ready for trial. However, negotiations for settlement and for a stipulated decree are pending.

Among other actions pending before the courts at the close of the fiscal year are the following:

1. *Ivanhoe Irrigation District* v. *All Parties and Persons*, No. 39627, filed in the Superior Court of the State of California, in and for the county of Tulare, which is a proceeding for validation of the water-service and distribution-system construction contract between the district and the United States. Hearings on demurrers by objectors to the contract continued through 1951. After a trial of the facts in April 1951, the court asked for submission of briefs. Oral arguments were made and final memoranda were filed at the close of the fiscal year 1952.

2. *Madera Irrigation District* v. *All Parties and Persons*, No. 8502, filed in the Superior Court of the State of California, in and for the county of Madera, which is a proceeding for validation of the water-service and distribution-system construction contract between the district and the United States. It is similar to Ivanhoe proceeding, but has additional complexities arising from the fact that excess landowners in the district claim vested rights to project water by virtue of the district's former ownership of certain lands and water rights. Hearings were held and briefs were filed.

3. *United States of America, petitioner* v. *Federal Power Commission, Pacific Gas and Electric Company, and Fresno Irrigation District*, for itself and as trustee for others, No. 13265, filed in the United States Court of Appeals for the Ninth Circuit, is an action requesting review by the Circuit Court of the proceedings had before the Federal Power Commission on application of the Pacific Gas & Electric Co., for license to develop power sites on the North Fork and main stem of the Kings River, and a similar application by the Fresno irrigation district et al. for a preliminary permit. Case should come on for argument late in 1952.

4. The action *United States* v. *Coachella Valley County Water District*, No. 14047–HW Civil, filed April 25, 1952, in the United States District Court for the Southern District of California, central division (Los Angeles), seeks a declaratory judgment as to certain rights and obligations of plaintiff and defendant under their contract of

December 22, 1947, for construction of the lateral distribution system and other works, Coachella division, All-American Canal system. Defendant filed its answer May 31, 1952. On June 30, the case was set over to July 7, 1952, for pretrial hearing on factual matters put in issue by defendant's answer.

5. The action *Hudspeth County and Reclamation District No. 1* v. *Howard E. Robbins et al.* (regional director, region 5, Bureau of Reclamation), in the United States District Court for the Western District of Texas, El Paso division, is a suit for declaratory judgment to establish Hudspeth district water rights and to enjoin offices of the United States from impounding and diverting certain waters allegedly belonging to the district. The defendants' motion to dismiss was overruled by the court shortly after the close of the fiscal year 1952.

6. The case of *State of New Mexico and City of Truth or Consequences* v. *Labon Backer et al.* (an officer of the Bureau), is a suit to enjoin defendants from draining Elephant Butte Lake. After removal of the case from the State court to the United States District Court for New Mexico, the suit was dismissed. An appeal was taken to the Court of Appeals, where the case was pending at the close of the fiscal year.

Various other actions affecting the Bureau of Reclamation were settled, continued, or filed during the fiscal year, including condemnation cases and tort and contract claims.

MANAGEMENT PLANNING

In collaboration with the regions and central-office divisions and offices, continued effort was made to identify specific problems in the operations, methods, and management of Reclamation activities. These problems were scheduled and attacked by the field and headquarters staffs, and a number of important solutions were developed and placed in operation. In compliance with the President's management-improvement program, this effort will be continued to improve operations and management throughout the organization.

The office participated in a Bureau-wide program to train and assist supervisory personnel at all levels in discharging their responsibility to provide adequate guidance to subordinate staffs, the objective being to promote and develop the ability of supervisors and employees to do their work correctly and avoid subsequent extensive revisions.

Self-appraisal methods developed last year were applied with good success and will be extended. Under this plan, each regional staff division reviews regularly and with management participation the activities under its jurisdiction at each operating office in the region. In addition to guiding the operating employees in the application of principles and techniques, the regional and management staffs become better acquainted with basic problems confronting the operating offices and the Bureau in the execution of programed functions and activities.

Substantial progress was made in the development of Bureau-wide methods for determining the ratio of employees to given workloads in selected Bureau activities. With further improvement, these methods of determining personnel requirements will be of great value as workloads shift within regions or between regions, and as Bureau programs increase or decrease by reason of congressional action.

During the past year emphasis has been placed on improving and consolidating the content of the Reclamation Manual, which now includes all continuing instructions for the guidance of employees in executing the Reclamation program. The demand for the Reclamation Manual and related management reports and documents continued particularly among universities and foreign governments.

Under the incentive-award system, wide participation among employees was achieved with consequent benefits both to the Bureau and to the employees who developed the improvements in operations and methods. The increased interest in the program was due largely to the decentralization of award authority to the field level, thus permitting prompt action upon employee proposals for procedural and other improvements.

The office initiated a system to provide standardized organization charting and functional descriptions throughout the Bureau, with corresponding automatic staffing data for the headquarters and regional staffs.

Through the review of reports and forms, particularly at the regional level, operations were improved through the consolidation or elimination of like or similar reports and forms and through the revision of the procedures relating to their use.

PERSONNEL

The general policy of "no new starts" created a problem of possible large-scale force reductions in certain areas, while limited recruitment, mostly at a lower grade, was necessary in others. Turn-over was high, the Bureau having a total of 16,595 full-time employees at the beginning of the year and 13,846 at the closing. This turn-over, coupled with aggressive internal placement activities, enabled us to avoid the demoralizing effects of large-scale reductions in force and to come within the money limitations for personal services; at the same time, it presented many problems of employee utilization, adjustment, reorganization, and consolidation of functions incident to the gradual shrinking of an organization of the Bureau's size.

No particular difficulty was encountered in the comparatively small amount of recruitment done at all levels during the fiscal year. However, serious difficulties are now being encountered in recruiting engineers at the GS–5 and GS–7 levels.

Management-training activities progressed satisfactorily, with (1) participation by six Bureau employees in the departmental management-training program; (2) continuation, on a limited scale, of the administrative and accountant-trainee program; (3) completion of six formal sessions of supervisory training for 100 top- and middle-level supervisors on the Columbia Basin project; and (4) definite plans made to launch a series of suggestion sheets on management. Rotation of GS–5 and GS–7 engineers was extended to three of the seven regions. The Central Board of Civil Service Examiners announced four open, continuous examinations, received 1,321 applications, rated 848 eligible, and recorded 371 appointments. We maintained contact with engineering colleges throughout the United States to facilitate employment of graduates and undergraduates.

Labor-management negotiations arriving at mutually satisfactory hourly rates of pay and working conditions were successfully carried out for the Columbia Basin project. A collective-bargaining agreement with the Colorado River Power Trades Council, representing all ungraded employees at the Parker Dam power project and the Davis Dam project, was executed in December 1951. Negotiations are presently under way for the development of similar agreements at the Central Valley project in regions 6 and 7. Authority was delegated to regional directors and the chief of personnel, field division, to approve wage rates for ungraded employees. This has resulted in more prompt alinement of the Bureau's wage schedules with local prevailing rates.

A plan for personnel management review and improvement was formulated and a successful "trial run" conducted in one district. The plan provides for measuring the effectiveness of the personnel program in terms of actual operating practices and offers an avenue for employee participation in the development or modification of management policies. It will have Bureau-wide application in fiscal year 1953.

The tempo of the Bureau's position classification program, including an over-all review of position allocations, was conditioned by the availability of trained technicians and funds, the need to coordinate with the Department and the Civil Service Commission, and the Bureau-wide support of management. Contacts with field installations were continued. Work also continued in the review of proposed Civil Service position classification standards, and with various regional Civil Service classification audit teams which visited Bureau offices. The foreign-activities program added substantially to the workload, and a similar effect was realized by the consolidation of wage administration with the classification function in the Washington office. Manual revisions were accomplished as required in order to reflect current policies, practices, and procedures.

Considerable work on staffing and ratios was done during the year. The personnel ratio of 1:115 contained in the Interior Appropriation Act of 1952 was administered in the Secretary's office on a Department-wide basis. The ratio was based on the number of employees engaged 50 percent or more of their time in personnel activities. This resulted in a reduction of personnel employees in some of our offices. A critical examination was made of all our personnel offices for achieving manpower conservation, our target being to achieve greater results with fewer people. At every level in our program the personnel staff devoted itself to assisting management in the establishment, development, and maintenance of a work force which would most effectively meet the Bureau's operational needs. Forecasting staffing requirements and programing placement of available employees according to workload was again emphasized.

The Bureau's safety program was continued and further intensified especially on organization and maintenance operations. Safety evaluations and inspections were performed on all Bureau operations. A program of safety education, by means of safety conferences, training courses, films, posters, and periodicals, was continued. Accidents were reduced 27 percent for Bureau employees and 6 percent on contract operations, as compared to the 1951 experience. The severity of accidents likewise reflected a decrease of 86 percent and 2 percent, respectively, during the same periods. The Federal employee-health program continued to operate in its pilot stage at the Denver Federal Center.

During the year 45 Bureau employees were assigned to duty in foreign countries under the President's point 4 and TCA programs. Staff personnel officials from the Washington and Denver offices made several trips to regional and field offices to give on-the-spot guidance and assistance. On June 30, 1952, the Bureau had on the rolls 13,846 full-time employees, 11,172 of whom were under the Classification Act; 2,674 were under wage board; 7,266 were entitled to veterans' preference; and 1,988 were women.

SUPPLY

Aircraft Operations

The Bureau of Reclamation maintained and operated a fleet of 8 aircraft consisting of 1 twin-engine, 10-passenger Lockheed Lodestar;

2 twin-engine, 5-passenger Beechcrafts; 4 single-engine, 3-passenger Ryan Navions; and one Bell helicopter. This fleet of aircraft has proved very successful inasmuch as it was used to transport Bureau and departmental staff personnel to areas not generally served by commercial transportation. The Bell helicopter was used in connection with inspection of proposed transmission line rights-of-way, inspection of power lines, aerial photographic surveys of features of various Bureau projects, surveillance of floodwater conditions, and general reconnaissance work.

Procurement

As a whole, the Bureau has been able to obtain priorities and allotments of critical materials in accordance with construction needs. Trenton Dam's Chicago, Burlington & Quincy Railroad relocation did suffer due to the inability to obtain steel at time it was required for construction. The Bureau is also unable to obtain nickel-bearing stainless steel which was most desirable for the turbine runners for the Flatiron Power Plant.

It is apparent that, due to the steel strike, shortages will exist to the effect that many of our projects will be unable to obtain material in accordance with our present construction schedule. It appears that plate steel and heavier structural shapes will be the most difficult to obtain.

The field Material Control Offices, which were established and given the responsibility of collecting and compiling current requirements for critical materials and preparing full and complete statements of essentiality as justifications for requests for allotments, have done an exceptionally fine job in presenting those requirements for issuing the allotments and priorities to suppliers and contractors.

Property Management

An intensive campaign was conducted to expedite disposal of all possible accumulations of metal scrap in view of the critical metal shortage. This program resulted in the return to trade channels, for reuse, of 1,575.4 tons of ferrous, and 117 tons of nonferrous scrap metals.

During the year excess and surplus usable personal property having an acquisition value of $1,022,917 was disposed of by sale and transfer; $317,668 was realized from the disposal of this property.

The work of further refinement and streamlining of our property accountability procedures and improvement of procedural instructions of property management manual was continued.

Following receipt of Bureau of the Budget Circular A–45 and departmental regulations covering the subject of establishment of rates for quarters and utilities furnished employees, instructions in compliance therewith were issued, following which a program of complete review of all Bureau rates was begun late this fiscal year.

An appraisal of all Bureau housing will be involved as well as a study of rates charged commercially for comparable housing in adjacent communities.

Any changes in rental rates as a result of this review will be made effective within the first part of the following year.

Service Management

In the disposition of records, 56 new, revised, or extended Bureau-wide schedules were issued which established standards for the retention and disposal of over 400 types of specifically described records.

Approximately 1,350 cubic feet of separated employee personnel status records were transferred to the custody of the Federal Records Center, St. Louis, Mo.

Considerable work has been imposed upon the Supply Division in performing supply services for the Office of Foreign Activities. This has been a rapidly expanding activity which has introduced unprecedented problems in furnishing the equipment and supplies and services needed by Bureau personnel on foreign missions.

REGIONAL REPORTS

Region I, Headquarters, Boise, Idaho

General Investigations.—The planning program for the region included work on 3 reconnaissance investigations, 3 basic surveys, 24 project investigations, 6 studies of existing projects, 4 advance planning studies, 5 studies classified as general engineering and research, plus special studies.

Final project investigation reports were made on the Payette Heights unit of the Boise project, Idaho; Savage Rapids Dam of the Grants Pass project, Oregon; Sequim project, Washington; and Goose Lake project, Oregon. A special report was prepared on the Rogue River Irrigation Association's proposal for the Rogue River Basin development along with a reconnaissance report on the Okanogan River Basin, Wash.

A definite plan report on the Palisades project, Idaho-Wyoming, was submitted to the Commissioner, but was returned to the regional office for further revision.

Special reports were also prepared on "Prediction of Snowmelt Floods Through Forecasted Temperatures" and on "Preliminary Studies of the Investigations of the Third Power Plant at Grand Coulee Dam, Columbia Basin Project, Washington."

A water management officer was appointed to carry out the Bureau's participation in the water management subcommittee of the Columbia Basin Inter-Agency Committee, and Bureau representatives continued to assist in developing an over-all operating plan. Engineering data was reviewed and summarized for the Interstate Compact Committee, which had been operating informally since 1950 but which Public Law 572, Eighty-second Congress, second session, now authorizes.

Construction.—As the Columbia Basin project entered its nineteenth year of construction, it was 58 percent completed. The total investment was $439,854,000 with $318,847,000 yet to be expended to complete facilities for irrigating the project's 1,029,000 irrigable acres. The highlight of the year's activities was the initial delivery of water to the first block of project lands. Arrival of the long-awaited water was marked by an 11-day celebration sponsored by the State of Washington. The ceremonies, particularly the "Farm-In-A-Day" (in which an 80-acre piece of sagebrush was in 1 day transformed into a fully developed farm, including a house and farm buildings) drew national attention.

Fiscal year 1952 was a testing year, in which water was made available for approximately 927 farms in 6 irrigation blocks. It was the beginning of a 7-year program, which is aimed at completing facilities for irrigating 500,000 acres or roughly one-half the project.

Among the major structures completed during the year were the Grand Coulee pumping plant, the second and third sections of the East Low Canal, spillway bucket repairs, and riverbank protection. At the end of the year contracts were let to build laterals and other project structures in blocks which will receive first irrigation water in 1954. Seven other contracts, covering laterals that will deliver first water in 1953, were nearing completion at the year's end.

The second of the huge irrigation pumps was put into operation in July 1952 and two other units were close to completion at the end of the fiscal year.

Another significant event of the year was the completion of the last three of eighteen 108,000-kilowatt generators at Grand Coulee Dam, bringing the total installation to 1,974,000 kilowatts, largest in the world.

At the close of the fiscal year, Hungry Horse project was 86.5 percent complete on the basis of expenditures.

All major phases of construction at Hungry Horse continued on or ahead of schedule, with the first major project goal—1,000,000 acre-feet of usable storage in the reservoir—reached at year's end. Hungry Horse powerhouse construction pointed toward first power delivery from the first and second 71,250-kilowatt generators on October 1 and December 1.

Concrete placement totaled more than 1,306,000 cubic yards, bringing the total yardage in place on July 1, 1952, to 2,865,000. The completed project will contain about 3,000,000 cubic yards of concrete. Mass placement was due to be completed in October 1952. The prime contract is expected to be completed by the end of fiscal year 1953, 5 months ahead of schedule.

First major construction work on Palisades Dam in eastern Idaho was started in June 1952 under a $29,180,346 prime contract. A contract for excavation of power and outlet tunnels, which will be used for diversion of the Snake River, was awarded the previous December. At the end of the year construction activities were gaining momentum, the prime contractor being engaged in constructing his camp, clearing, stripping of borrow and stockpile areas, building a bridge and haul roads, and relocating highway and Forest Service roads.

All principal features at Anderson Ranch Dam of the Boise project were completed. The second 13,500-kilowatt generator was placed in operation on July 25, 1951.

On the Payette division of the Boise project, emergency repairs were made on Black Canyon Dam, involving drilling drainage holes to reduce uplift pressures and construction of a concrete apron at the toe of the overflow spillway. In the Cascade Reservoir area, the relocated state highway was completed except for surfacing. Reservoir clearing continued with completion schedule for early fiscal year 1953.

On the Deschutes project, clearing of Wickiup Reservoir neared completion. Construction on the North Side pumping division of the Minidoka project, Idaho, was limited to completion of six observation wells to determine the effect of pumping on the water table. On the Roza division of the Yakima project, 2,000 feet of main canal was lined, and rehabilitation of Kachess Dam outlet works channel was completed. Rehabilitation of the spillway at Keechelus Dam is scheduled for early in fiscal year 1953.

Operation and maintenance.—Operation and maintenance activities in region 1 were highlighted by a record gross crop value and initial delivery of water to the Columbia Basin project.

Crops valued at $230,462,400 were produced in 1951 on 2,035,039 acres under cultivation in the region. The previous high gross of $225,235,236 was made in 1946. The average 1951 gross per acre return was $113.25.

Approximately 927 farms were ready to be served for the first time on the Columbia Basin project by summer 1952, and water became available in 1951 to irrigate 120 new farms on the second unit of the Payette division, Boise project, and 144 on the Roza division, Yakima project. The latter two new land areas totaled 18,686 acres. Some 87,000 acres of land were to be served on the Columbia Basin project in 1952.

Five sales of Government-acquired land were held on the Columbia Basin project, making available 53 part-time farm units and 121 full-time units. The latter sales drew 12,022 applications. Farm unit layouts have been completed on 7,250 acres of irrigable lands to be opened to homesteading soon on the North Side pumping division, Minidoka project. This includes land currently under agricultural lease that is served by 11 wells and land which will be irrigated by five new wells authorized for construction in fiscal year 1953.

Creation of a fifth "development" farm on the Columbia Basin was begun. Cooperative settler assistance programs were continued in Oregon, Washington, and Montana in accordance with the Bureau's policy of cooperating with land-grant colleges and universities. Amendatory repayment contracts were made effective with four irrigation districts of the Boise project (Boise-Kuna, Big Bend, Nampa-Meridian, and Settlers). In addition, a contract was completed with the Okanogan district for rehabilitation work on Conconully Dam. Congress approved contracts with the Frenchtown and Owyhee projects. Negotiations on amendatory contracts were continued with the Payette division of the Boise project, Roza division of the Yakima project, North unit, Deschutes project the Riverside district of the Boise project.

The New York irrigation district of the Boise project made final payment on its construction cost obligation on Arrowrock Dam in May 1952 and Sunnyside Valley irrigation district of the Yakima project completed pay-out of its obligation to the Government in June 1952.

Power.—The Bureau's six hydroelectric plants in region 1 established a new record generation of 14,812,858,340 kilowatt-hours during the fiscal year. Gross revenues from power operations amounted to $12,324,321.

Grand Coulee Dam's nameplate capacity was increased to 1,974,000 kilowatts with the installation of the last 108,000 kilowatt units of the presently authorized plant. A world's record peak load of 2,226,000 kilowatts was carried in December 1951 and generation for the year was also a record—14,465,350,000 kilowatt-hours. A monthly world's record was established in August—1,358,714,000 kilowatt-hours.

Installation of the second unit at Anderson Ranch Dam's power plant in Idaho was completed. The unit is rated at 13,500 kilowatts.

Production from that plant, together with that from the 8,000-kilowatt Black Canyon, 1,500-kilowatt Boise River, and 5,000-kilowatt Minidoka unit 7 plants, totaled 245,943,100 kilowatt-hours, and gross revenues totaled $703,055.

Gross revenues for the 8,400-kilowatt Minidoka 1–6 plant amounted to $459,093. This plant generated 76,100,300 kilowatt-hours. The 2,400-kilowatt Prosser plant of the Yakima project produced 25,465,450 kilowatt-hours to earn $62,172.

Region II, Headquarters, Sacramento, Calif.

General investigations.—Planning work continued on 6 basin surveys, 13 project investigations, one study of an existing project, and one advance planning study.

Regional director's reports were completed on the Trinity River Division; Sacramento Canals unit, Sacramento River Division; North Fork Kings unit, Kings River Division; and Santa Maria project. Definite plan reports on Cachuma project, Klamath Straits unit, and Solano project were transmitted to the Commissioner. A fourth definite plan report covering the Sly Park unit was completed in draft form. Final investigation reports on Pine Flat Power unit, Kings River Division, and Clikapudi unit, Sacramento River Division, were scheduled for completion early in fiscal year 1953, proposed drafts having been finished in 1952.

In addition to these reports, work was accomplished on a variety of hydrologic, geologic, engineering, and economic investigations for the over-all Central Valley Basin and subdivisions, including Upper American River Basin; Feather River Basin; Black Butte unit, Stony Creek Division; Folsom Canals unit, American River Division; Upper San Joaquin Division; San Luis Division; and San Francisco Bay Division.

In the Klamath River Basin a comprehensive survey is continuing in which Reclamation is cooperating with the Fish and Wildlife Service and the Bureau of Indian Affairs, and a Butte Valley project investigation was started. A Santa Ynez Basin survey also is continuing.

A special study was prepared for inclusion in the report on drought conditions in the Southwest.

Substantial progress was made in 1952 in the following investigations with reports scheduled for completion in the 1953 fiscal year: Pajaro River Basin; Sacramento Canals power plant unit; Stony Gorge power unit; Union Valley unit, American River Division.

Construction.—The most significant accomplishment of the year in region 2 was the first integrated operation of the Central Valley project made possible by completion of initial features of the Delta Cross Channel, Tracy pumping plant, Shasta-Tracy transmission line, and the final reach of the 117-mile-long Delta-Mendota canal.

On the CVP two sizable construction contracts were awarded during the year: for the 162,000-kilowatt Folsom power plant at $5,772,959 and for Nimbus Afterbay Dam and power plant of 13,500-kilowatt capacity at $6,067,353. Construction of Folsom power facilities is being closely coordinated with construction of Folsom Dam by the Corps of Engineers so that power generation may begin in fiscal year 1955.

In the Shasta-Keswick area construction activities during 1952 were limited to completion work. Construction of a road on the west side of Shasta Reservoir will proceed in fiscal year 1953 under terms of a contract between the Bureau and Shasta County.

The Columbia and Mowry pumping plants and delivery systems above Mendota-Pool were virtually completed at the close of the fiscal year.

Major attention during fiscal year 1952 centered on the construction of Friant-Kern canal distribution systems. The first unit has been finished for the Southern San Joaquin municipal utility district system and is in operation, with construction well along on the second and third units. The first and second units of the Lindmore irrigation district system are completed and in operation with work nearing completion on the third. The first unit for Exeter and the system for Lindsay-Strathmore are more than 80 percent complete, and construction is well under way on the Ivanhoe system. Plans and specifications have been prepared for Stone Corral and are under preparation for Saucelito, Delano-Earlimart, and Unit 2 of Exeter irrigation district. These are scheduled to be under construction in fiscal year 1953.

On the Cachuma project the Goleta section of South Coast conduit was completed and placed in interim operation utilizing water supply from Tecolote tunnel. At the end of the fiscal year construction of Lauro Dam was 72 percent complete; Tecolote tunnel was 80 percent excavated; Cachuma Dam was 62 percent complete with considerable amount of concrete placed in the spillway, and embankment placing being accelerated to complete closure before the next rainy season. When construction contracts are awarded in fiscal year 1953 for two regulating reservoirs and three lateral systems, the entire Cachuma project will be under construction.

New construction contracts were awarded during the fiscal year on Klamath project covering earthwork and structures in N canal area, Tule Lake sump, and outlet structure for pumping plant No. 6, 99 percent complete; and Lost River channel improvement, upper Langell Valley and W–1 lateral, 24 percent complete; and pumping plants

R and S, 17 percent complete. Work on lower Lost River channel mprovement and North Main dike being completed and total contact ver 90 percent complete.

Operation and maintenance.—The first integrated operation of the nitial features of the Central Valley project in August 1951 was nder the direction of the CVP operations office. Working as a unit or the first time, storage and canal systems, pumping and power lants operated for the benefit of the area in supplying irrigation, nunicipal, and industrial water, power, storage of floodwaters and ontrolled releases to limit salt-water intrusion.

Recreational use of reservoirs increased at Shasta and Millerton akes of the CVP and on the Orland and Klamath projects.

Sixteen temporary contracts for water service along the San Joaquin River and Friant-Kern and Delta-Mendota canals were andled. Negotiations were carried on for proposed amendatory ontracts with Delano-Earlimart and Saucelito irrigation districts, nd were approved as to form by the Secretary.

A temporary municipal and industrial water-service contract was pproved for the Friant-Kern canal and negotiations begun toward ermanent municipal and industrial water service from the Friant-Kern and Delta-Mendota canals.

Two temporary water-service contracts were executed on Cachuma project. A distribution system repayment contract was executed in April with the Goleta County water district and a similar proposed contract has been approved as to form by the Secretary.

One repayment contract was executed on the Klamath project. This is the first of a program for consolidating individual water-rights contracts and marketing additional rights to districts along the fringes of the project.

Fifteen recordable contracts covering 11,982 acres of excess land were executed under terms of Reclamation law.

Objectives for fiscal year 1953 on the CVP include completion of contract negotiations with the remaining districts in the Friant-Kern and Delta-Mendota canal service area, and in the Kings River area. In the Klamath project the program includes completion of repayment contracts with the Tule Lake division, P Canal area district, Poe Valley improvement district, and several amendatory contracts. In the Sacramento Valley district the objective will be negotiation of water service contracts with several irrigation districts whose formation is now being considered.

Land classification and land use studies were completed on approximately 900,000 acres. This work consisted of agricultural surveys and crop mapping for the purpose of determinations of beneficial use of water for water-rights investigations, determination of water requirements for water sales contracts, and land studies for preliminary investigation and definite plan reports.

Power.—Fiscal year 1952 was marked by the begining of service under terms of the transmission and exchange (wheeling) contract with the Pacific Gas & Electric Co. By the end of the year service was being furnished by wheeling to 12 preference customers and to 1 project load.

In December 1951 a new sale and interchange contract with the P. G. & E. became effective. The significant feature of this contract is that the company agrees to provide limited amounts of energy for firming up the hydroelectric output of the CVP.

Total revenues received from sale of power during 1952 totaled $9,894,306.39 for the sale of 2,514,851,476 kilowatt-hours.

The Tracy-Contra Costa 69-kilovolt transmission line was completed and placed in service in November.

The CVP radio network was completed, operating criteria developed and tentative expansion studies were made to include future projects.

Local power requirements of defense installations, municipalities, irrigation districts, and other preference customers are such that the sell-out point of CVP power is being rapidly approached. Because of rapidly expanding civilian and defense requirements, discussions have been held with the Colorado River Commission and the city of Los Angeles for possible service to those areas. Successful completion of present negotiations will preclude further service to new customers unless additional sources of supply are developed.

Region III, Headquarters, Boulder City, Nev.

General investigations.—Field forces completed diamond drilling, geologic exploration, and surveys of the mile 39.5 dam site in Marble Canyon on the Colorado River. Power and design studies on potential Bridge Canyon Dam were continued.

On the basis of Bureau investigations, the Congress appropriated funds to the Navy for construction of a second barrel to the San Diego aqueduct. As agreed with the Navy, the Bureau will design and construct the second barrel.

Construction.—Davis Dam project construction continued in its final stages. The spillway stilling basin and excavation in the tailrace, contracted last fall, are scheduled for completion in fiscal year 1953. The transmission system as originally planned is practically complete and requires only minor additions to substations, installation of supervisory control, and other work needed to facilitate operations. In the operation and maintenance area at Phoneix, repair shops, warehouse additions, and headquarters building are nearing completion and installation of utilities and area improvements is under way.

Installation of two Hoover Dam power plant generating units, A–4 for the State of Arizona and A–9 for the State of Nevada, was virtually complete.

On the Gila project the 18½-mile Wellton-Mohawk canal, its three large pumping plants, and substantial reaches of the Mohawk and Wellton branch canals were completed. Construction continued on the Coachella Valley underground concrete pipe distribution system. Rehabilitation and betterment work continued on the Salt River project; completed were a canal pumping plant for replacement, the first stage of rehabilitation of Stewart Mountain Dam, and extensive areas of concrete canal and lateral lining.

Operation and maintenance.—Region 3 farms irrigated by Reclamation works in 1951 produced an all-time record crop value of approximately $205 million on 871,548 acres, exceeding the previous record set in 1948 by 20 percent. At the close of the fiscal year temporary water deliveries were being made at canal side to approximately 9,000 acres on the Wellton-Mohawk division, Gila project. Within a few years some 75,000 acres on the division will be served by the canal system. A $42 million repayment contract, signed at Yuma by Under Secretary of the Interior Richart D. Searles acting for the Government, was executed with the Wellton-Mohawk irrigation and drainage district in March 1952. On May 1, 1952, Commissioner Michael W. Straus turned the first water onto Wellton-Mohawk lands as a feature of Arizona's Golden Jubilee celebration.

Twenty-seven farms, comprising 4,030 acres of homestead land on the Yuma Mesa division, Gila project, were opened to entry. A public drawing for the farms, involving 4,111 veterans who had filed applications, was held in Yuma, Ariz., on June 3, 1952.

The California headworks and abutment of Imperial Dam, the desilting works, the first 20 miles of the All-American Canal, and the first 50 miles of the Coachella Canal were accepted as completed by the Imperial irrigation district on May 1, 1952, for operation and maintenance. This completes the full turn-over of the dam and canal facilities contemplated by the Government's contracts with that district.

Indirective of Reclamation's indirect benefits are the estimated Federal tax payments in 1951 of $90 million from Maricopa County and $8.5 million from Yuma County, Ariz. A report on local irrigation accomplishments of the Yuma and Gila projects indicated that the local indirect benefits are 1¾ times the direct benefits.

On July 1, 1951, the Yuma County Water Users' Association assumed the care, operation, and maintenance of works on the Valley division, Yuma project, in accordance with the terms of the transfer contract executed June 15, 1951.

Following a recommendation of the Reining report, the administrative separation of Boulder City, Nev., municipal operations from the Boulder Canyon project was authorized by Secretarial Order No. 2650 and effected as of July 1, 1952. In November 1951 at the city's first municipal election, voters selected representatives to serve on the special committee to assist in the choice of a city manager and on the advisory council to work with the city manager. Each committee was to include seven members—four elected by the voters and three designated by the Bureau of Reclamation, other governmental agencies in Boulder City, and the power allottees, respectively. Harold N. Corbin, former city manager of Porterville, Calif., was appointed city manager and entered on duty May 19, 1952.

Power.—Reclamation hydroelectric power plants on the Colorado River at Hoover, Davis, and Parker Dams, and at Siphon Drop on the Yuma project, generated 7⅓ billion kilowatt-hours of energy. This topped the earlier record output set in fiscal year 1944. The Colorado River plants furnished 36 percent of all electricity used in southern California, southern Nevada, and Arizona during the fiscal year.

Arizona's two new units in the Hoover power plant, A–3 and A–4, will furnish that State with its 18 percent allocation of Boulder Canyon project power. In a Reclamation Golden Jubilee ceremony on April 30, 1952, Under Secretary of the Interior Richard D. Searles pressed a button in the Hoover power plant to place A–4 on the line. Nevada's unit A–9, placed in service early in 1952 and supplemented by service from N–7, provides the State with its allocation of Hoover power, also 18 percent. Other Hoover units, the first of which went into commercial production in 1936, furnish power to California allottees.

The Davis Dam power plant generated 1,364,000,000 kilowatt-hours of energy during the fiscal year—its first full year of operation. On the Davis transmission system, Maricopa, Cochise, and Pilot Knob substations were placed in service. The Wellton-Mohawk pumping plant substations, the 34.5-kilovolt lines serving them, and the second transformer bank at Coolidge were also placed in service.

Water releases through the turbines at Hoover, Davis, and Parker Dams were stepped up early in 1952 to draw down Lake Mead in anticipation of a record April through July runoff. Special contracts were negotiated for the sale of additional energy thereby generated at the Davis and Parker power plants, and over a billion kilowatt-hours of secondary energy were generated at the Hoover power plant.

As a result of cooperative planning by the Bureau, the Arizona Power Authority, and the Arizona Public Service Co., the latter will construct a new steam plant near Red Rock, Ariz. Energy from this privately owned plant will be transmitted under a wheeling agreement to major load centers through Bureau facilities. Planning and design work for the additional facility construction required to meet wheeling agreement terms have begun.

River control.—Colorado River dredging continued along the designed channel alinement opposite Needles, Calif. The Needles-to-Topock channel was opened a year ago and within 24 hours was carrying about 90 percent of the river's flow. Within a week the water surface elevation of the river opposite Needles had dropped about 3½ feet, making it about 6 feet lower than the high river elevation late in 1944 during which the lower part of that city was inundated.

Colorado River levee construction near Yuma, Ariz., progressed materially. A part of this work is being done under provisions and requirements of the Mexican Water Treaty of 1944.

The 1952 spring runoff on the Colorado River of 14 million acre-feet exceeded the maximum recorded spring flow at the Grand Canyon gaging station by 1½ million acre-feet. The previous high recorded flow was 12½ million acre-feet in 1929. The normal runoff for the period of record is 9.6 million acre-feet.

Region IV, Headquarters, Salt Lake City, Utah

General investigations.—Planning engineers completed definite plan reports for the $70,000,000 Weber Basin project, Utah, and for the 5,000-kilowatt Deer Creek power plant, of the Provo River project, Utah, as well as an authorizing report for the Gooseberry project, Utah—the latter completing a group of 11 reports for as many participating projects recommended by the States of the upper Colorado Basins for initial development in connection with the Colorado River storage project reported in fiscal year 1951. A status report was also prepared on the South San Juan project, New Mexico, showing its relationship to the potential Shiprock Indian project and providing basic information useful in the selection of the most favorable plan for development of New Mexico's 11.25 percent allocation of water from the San Juan River.

Soils scientists completed a detailed land classification for the Eden project, Wyoming, and the Rock Springs, Wyo., area office also completed some appendices to the Eden project definite plan report delayed by policy problems during fiscal year 1951.

Fiscal year 1953 planning objectives include early completion of a definite plan report on the July 3, 1952, authorized Collbran project, Colorado, and continued detailed investigation of the Eden project. Work will be continued, with the aim of completing reports in some instances, on the Fruitgrowers Dam project extension, Colorado; Bear River, Utah and Idaho; Washoe, Nev.; Cliffs Divide, Colo.; Sublette, Wyo.; San Miguel, Dolores, and Animas-La Plata project, all in Colorado; and Pack Creek, Utah.

Construction.—Contractors accomplished about 80 percent or $4,728,000 of a $6,032,000 program during fiscal year 1952, as compared with 83 percent of a $7,444,000 goal the previous year. The accomplishment included completion in December 1951 of the final feature of the Aqueduct division, Provo River project, Utah, namely the 40,000,000-gallon Terminal Reservoir. The aqueduct supplies Salt Lake City with storage water from Deer Creek Reservoir, 41 miles distant. Duchesne tunnel was "holed through" on December 10, 1951. The entire invert of the tunnel was concreted by June 12, 1952. Except for construction of a Deer Creek power plant and additional Provo River channel revisions, the project was essentially completed.

Award of a $500,000 contract for work on Eden canal accelerated construction activities on the Eden project, Wyoming, where the contractor had completed 86 percent of the Big Sandy Dam and Dike by the end of the fiscal year. The first schedule of construction on the Means canal was 40 percent completed at the end of the fiscal year.

The Eighty-first Congress approved resumption of construction on the Fire Mountain canal extension, Paonia project, Colorado, and work was scheduled to start about October 1952. The contractor completed three siphons on the High Line canal of the Grand Valley project, Colorado, under the rehabilitation and betterment program.

Earth slides, caused by excessive moisture in the vicinity of Jackson Gulch Reservoir of the Mancos project, Colorado, necessitated relocation of the center line of a portion of the inlet canal as well as replacement of access roads. The fiscal year 1953 program called for placement of additional concrete covers along the slough section of the canal and other preventive maintenance measures to retard and possibly reduce damage from future occurrences of this nature.

Under the S. & M. C. program, Government forces placed a test and demonstration canal lining in reaches of the Yellowstone feeder canal, Moon Lake project, Utah, where excessive leakage has occurred; elsewhere construction forces initiated channel improvement work on the Badger Wash, Grand Valley project, Colorado.

Initiation of construction on the $70,000,000 Weber Basin project, enabled by a $1,350,000 "new start" appropriation by the Eighty-first Congress, will be region 4's major construction objective during the first half of fiscal year 1953. The initial undertaking was to be excavation of the 3.3-mile Gateway tunnel through the Wasatch Mountains directly east of the Hill Field Air Base near Ogden, Utah.

Operation and maintenance.—Twenty operating projects in region 4 reported a 1951 gross crop value of $39,167,419 from 532,714 acres of irrigated land, an average of $73.52 per acre as compared with a $58.70-per-acre figure from 545,485 acres the previous year.

Fiscal year 1952 accomplishments of operation and maintenance technologists included: classification of approximately 4,600 acres of land in the Pyramid Lake Indian Reservation in cooperation with the Bureau of Indian Affairs; cooperation with local interests in coping with emergency floods caused by the record winter snowfall, particularly in northern Utah and western Nevada; cooperative work on lower cost canal lining; December 21, 1951, notice to the South Ogden Conservation District that the additional works to be constructed for the district were completed and that the $6,801 first installment of the $272,062 construction cost would be due and payable March 1, 1953; December 27, 1951, notice to the Metropolitan water district of Salt Lake City that, in addition to the aqueduct, the district would be responsible for operation and maintenance of the Terminal Reservoir, effective April 1, 1952; receipt of $310,000 from the Metropolitan water district of Salt Lake City as the first installment on excess costs of the Aqueduct division, Provo River project, Utah; issuance of notice on May 2, 1952, to the Provo River Water Users Association officially transferring to the association the operation and maintenance of the Provo Reservoir canal and the Weber-Provo diversion canal enlargement.

Power.—Electrical engineers further advanced investigations and studies on seven projects with power-development possibilities as follows: Colorado River storage, 1,622,000 kilowatts; central Utah, 61,000 kilowatts; Washoe, 60,000 kilowatts; Bear River, 27,500 kilowatts; Weber Basin, 5,400 kilowatts; Provo River, 5,000 kilowatts; and Sublette, 94,000 kilowatts. They also completed the power sections of the definite plan report for the Weber Basin project and the Deer Creek Power Plant of the Provo River project, and started work on the power aspects of the Collbran Project Definite Plan Report. Considerable work was also accomplished in connection with network analyzer studies for the potential over-all regional power system.

In fiscal year 1953 studies will be continued on the foregoing projects and, in addition, investigations will be conducted on the power possibilities on the Animas-La Plata, Dolores, and San Miguel projects in southwestern Colorado, and the Cliffs Divide project in northwestern Colorado.

Region V, Headquarters, Amarillo, Tex.

General investigations.—Final drafts of reports on the Washita River Subbasin and unfavorable report on the Fort Gibson project Oklahoma, were completed. Preliminary draft of the Brownwood project report, Texas, was distributed to Federal and State agencies and the Commissioner. An interim report on the San Juan-Chama project, Colorado-New Mexico, was forwarded to the Commissioner Field drafts of an unfavorable report on the Balmorhea project, Texas; Definite Plan Report (vol. I) on the Vermejo project, New Mexico; and Definite Plan Report (vol. IA) on Initial Stage Channel Rectification on the Middle Rio Grande project were received in the regional office. Reports on Reconnaissances of the West Texas project and Nueces River Power project, Texas, were completed for regional use. Investigations of the Arkansas-White, Red River Basins continued. Preparation of a report summarizing reconnaissance of the Gulf Basin was initiated. Collection of data on the Pecos River Basin continued. Initiated advance planning on the Canadian River project, Texas. Objectives for fiscal year 1953 include early submittal to Commissioner of volume I of Definite Plan Reports on Vermejo project and Initial Stage Channel Rectification of Middle Rio Grande project; completion of Bureau's contribution to the Comprehensive Report on the Arkansas-White, Red Basins; submittal to the Commissioner of report on the power phase of the lower Nueces River project, and an unfavorable report on the Balmorhea project; completion of field drafts of Canadian River Project Definite Plan Report, volume I, and of feasibility report on the power phase of that project, completion of field draft of Middle Rio Grande Project Definite Plan Report (vol. IB: Drainage); completion of a summary report on the Gulf Basin; completion of a program report on the San Juan-Chama project and initiation of feasibility studies upon approval of the program report; continuation of essential records on the Pecos River Basin.

Construction.—In fiscal year 1952, the asphalt membrane lining, a section of Altus canal, was completed, as well as the earthwork and structures on Altus laterals, drains E, A–1 162, and F (extension) of the W. C. Austin project, Oklahoma. The Platoro Dam, San Luis Valley project, Colorado, and the Socorro-Albuquerque transmission line, Belen-Willard transmission line, and Belen Substation, Rio Grande project, New Mexico, were also completed during the year. All Rio Grande project transmission facilities are expected to be completed early in fiscal year 1953, except for Albuquerque metering equipment. Addition of overhead ground wire is subject to approval by authorities. Channelization of the Middle Rio Grande project was started and will continue through fiscal year 1954. Award of second channelization contract was delayed by Budget Bureau action. The first construction contract for Vermejo project, New Mexico, is expected to be let by February 1953. Contract was awarded for exploratory drilling, Sanford Dam site, Canadian River project, Texas.

Operation and maintenance.—Seven projects are in operation. Three are fully operated by the Bureau; two by water users; one is a W. C. U. project operated by water users; and one Warren Act contractor. Operation of the W. C. Austin project, Oklahoma, will be transferred to the water users October 1, 1952. The Bureau also operates Alamogordo and Platoro Dams. All project crops were good in 1951 despite severe water shortages in the Rio Grande Basin. On the seven projects, 294,408 irrigated acres produced a total gross crop value of over $63,000,000, an average of $214 per acre. Water shortages continue on the Rio Grande and Carlsbad projects, and a shortage is developing on the Tucumcari project. Maintenance and replacement programs, particularly on older projects, were accelerated. A repayment contract with the Middle Rio Grande Conservancy District for project rehabilitation was completed, and a basis was established for negotiation of a contract with the Vermejo Conservancy District, New Mexico. The rehabilitated Fort Sumner project was placed in full operation. Platoro Dam and Reservoir, San Luis Valley project, Colorado, was ready for operation but will not be used for irrigation storage until next season. An active soil- and moisture-conservation program on Federal lands under Bureau jurisdiction was in progress on the Rio Grande and Tucumcari projects, Alamogordo Reservation and McMillan Reservoir delta area. The program includes salt-cedar control, water-conservation studies, and construction to protect land and structures from effects of torrential flood flows and erosion. The soil- and moisture-conservation program will be expanded, particularly on the Rio Grande project with the Picacho Arroyo control works under construction.

Power.—Total energy sales in 1952 on the Rio Grande project were 107,842,909 kilowatt-hours, of which 17,404,621 kilowatt-hours were sales of energy produced by the hydro generating plant at Elephant Butte Dam, N. Mex., and 90,438,288 kilowatt-hours were sales from purchased power. Actual runoff in Rio Grande watershed was far below early estimates. This continued low-water condition at Elephant Butte Reservoir has caused generation of electrical energy to remain below normal. The Rio Grande Power System has increased to 495 miles of 115-kilovolt transmission line with completion of 77 miles of line from Socorro to Albuquerque, a newly constructed substation at Albuquerque, 53 miles of line from Belen to Willard, with a newly constructed substation at Willard.

Region VI, Headquarters, Billings, Mont.

General Investigations.—Investigations to obtain material for basin reports were carried forward on 25 divisions. No basin reports were submitted in fiscal year 1952, but the reports for Cannonball and Clarks Fork divisions are scheduled for completion in fiscal year 1953, with the former to be submitted to the Commissioner before the close of the year. Definite-plan reports for Jamestown, Missouri diversion, Moorhead, Nickwall and Charley Creek, Rapid Valley and Sadie Flat units, and the revised reports for Hanover and Cartwright units were submitted to the Commissioner. None of the reports had been approved at the close of the fiscal year. The report for Cartwright unit recommended that activities be postponed due to the low benefit-cost ratio. In fiscal year 1953, the reports for Bluff, Boysen, Canyon Ferry, Helena Valley, Kaycee, Seven Sisters, Shoshone Extensions, Sidney and Stipek units and Riverton project (Third division), plus the revised reports for Rapid Valley and Crow Creek units, are scheduled for completion and submission to the Commissioner.

Construction.—The following construction was completed by contract during the fiscal year: Prime contract for Boysen Dam power plant and relocation of Chicago, Burlington & Quincy Railroad, relocation of the Chicago, Burlington & Quincy footbridge and clearing of the reservoir area, Boysen unit; extension of Wyoming canal and laterals, fencing along Muddy Creek, roads and bridges and construction of tetrahedrons along Five-Mile and Muddy Creeks, moving and erecting residences for operation and maintenance camp, some canal lining work on Pilot and Wyoming canals and riprap protection at Pilot Butte Power Plant, Riverton project; C. J. Coulee Crossing and lining portion of Heart Mountain canal, Shoshone project; Shadehill Dam and damtender's residence, Shadehill unit; power plant at Angostura; residence for development farm, Oahe unit; relocation of county road and clearing reservoir areas, Keyhole unit; reconstruction and relocation of county road, Dickinson unit; fencing and cattle guards, Heart Butte unit; Circle, Wolf Point, Savage, Havre, Shelby, and Rudyard Substations, towers and hutments for radio relay station, moving buildings to Havre Substation, Fort Peck project; lining portion of Vandalia south canal, Milk River project; warehouse, chain-link fence and clearing part of reservoir area, Canyon Ferry unit; portion of Tiber Camp, Lower

Marias unit; Garrison-Voltaire, Devils Lake-Lakota, Jamestown-Valley City, Voltaire-Rugby-Devils Lake-Carrington-Jamestown, Garrison-Fort Peck Tie and Alcova-Boysen transmission lines, Transmission division; and Rugby, Devils Lake, Carrington (except for installation of current transformer), Leeds (substantially), Bisbee (substantially), Lakota (substantially) and Thermopolis Substations, access road and chain-link fence for Bismarck Substation, Transmission division.

Construction continued during the fiscal year on the following contract work carried over from fiscal year 1951: Canyon Ferry Dam and Power Plant; irrigation facilities, Angostura unit; Keyhole Dam and relocation of State Highway No. 14, Keyhole unit; Fort Randall-Gregory-Winner, Sioux Falls-Brookings, Armour-Fort Randall Tap-Gavins Point Tap, Huron-Armour, Gavins Point Tap-Sioux Falls, Brookings-Watertown, Watertown-Groton-Huron, Rapid City-Midland, Canyon Ferry-East Helena, Glendive-Williston, and Thermopolis-Lovell 115-kilovolt transmission lines; Bismarck-De Vaul and Garland-Lovell 69-kilovolt transmission lines; Fort Randall-Oahe-Mobridge-Bismarck, Garrison - Washburn - Bismarck and Bismarck-Jamestown 230-kilovolt transmission lines; first-stage construction on Sioux Falls, Watertown, Huron, Woonsocket, and Mount Vernon Substations; and Lovell, Washburn, Bismarck, Jamestown, Rolla, Forman, Edgeley, and Valley City Substations.

Construction contracts were awarded in fiscal year 1952 and will be completed in future fiscal years for the following: residences at Angostura Dam; relocating Chicago & North Western Railroad, completion of power plant and line connections to the switchyard, Boysen unit; clearing land above Winston Bridge and to head of reservoir, Canyon Ferry; irrigation facilities for Fort Clark unit; Jamestown Dam; water supply system for Shadehill Development Farm; moving Chester Camp to Tiber Dam site, Lower Marias unit; lining portions of Pilot and Wyoming canals, retaining wall for Pilot Butte Power Plant, structures for Wyoming laterals (station 1606–2560), and pervious fence for Muddy Creek streambank revetment, Riverton project; Heart Mountain Camp restoration and drains, Shoshone project; Lovell-Yellowtail 115-kilovolt transmission line; first-stage construction of Armour, Beresford, Brookings, Flandreau, Groton, Tyndall, and Summit Substations; Bonesteel, Gregory, Midland, Philip, Wall, Wicksville, Winner, Custer Trail, De Vaul, Fort Clark, and Dawson County Substations; and extra bay at Williston Substation. In addition, specifications were issued for the Fort Randall-Sioux City 230-kilovolt transmission line, drains for the North Pavillion area on Riverton project and Hay Coulee Siphon on Milk River project.

Construction of all of these items under contract will be completed in fiscal year 1953 except for the following: Canyon Ferry Dam and Power Plant; clearing land to head of reservoir, Canyon Ferry unit; Jamestown Dam; and Fort Randall-Oahe-Mobridge-Bismarck and Fort Randall-Sioux City 230-kilovolt transmission lines. An additional 7,100 acres of land will be irrigated (Angostura, 4,000 acres; Fort Clark unit, 2,100 acres; and Shoshone project, 1,000 acres at camp area) and 15,000 kilowatts of power will be available from Boysen unit. Keyhole Dam will supply supplemental water to 55,708 acres on the Belle Fourche project.

In addition, in fiscal year 1953, major construction contracts scheduled for award include: Tiber Dam, Lower Marias unit; Missouri diversion dam; Pactola Dam, Rapid Valley unit; irrigation facilities for Crow Creek and Heart Butte units; Oahe-Midland and Fort Randall Tap-Fort Randall 115-kilovolt transmission lines; Crow Creek, Jamestown (addition), Grand Forks, Sioux City, Fargo, Rapid City, Weaver and Circle (addition which will be completed in fiscal year 1953) Substations; and second-stage construction of Sioux Falls, Flandreau, Brookings, Watertown, Summit, Groton, Huron, Woonsocket, Mount Vernon, Armour, Tundall, and Beresford Substations.

Operation and maintenance.—The 12 operating projects in region 6, receiving a full water supply from Bureau works, produced crops in 1951 worth $19,733,619 from a net area under cultivation of 455,548 acres. The Bureau delivered supplemental water to an additional 7,101 acres, from which the gross crop value was $226,973.

During the fiscal year, a repayment contract was executed by the United States with the Fort Clark irrigation district. Lower Yellowstone irrigation districts Nos. 1 and 2 executed amendatory repayment contracts. Congress authorized execution of amendatory contracts with the Glasgow and Malta irrigation districts of the Milk River project and the Midvale irrigation district of the Riverton project. An amendatory contract was executed with the Willwood irrigation district of Shoshone project. Also, amendatory contracts among the United States and Buffalo Rapids irrigation districts Nos. 1 and 2 and the Buffalo Rapids Farm Association were executed. A contract was executed in December with the city of Dickinson for operation of Dickinson Dam and Reservoir. Negotiations continued for development of a municipal water service contract with the city of Rapid City for water from the proposed Pactola Reservoir. Also, negotiations are continuing on development of a repayment contract with the Heart Mountain division of Shoshone project.

The Huron, Redfield, Mandan, Bowbells, and Riverton Development Farms were in operation during the fiscal year. Field activities on the Shadehill Development Farm were started, but the farm will not be in complete operation until August 1952.

Power.—During the year, 616 miles of 115-kilovolt transmission ines (Glendive-Miles City, Havre-Shelby, Alcova-Boysen, Boysen-Thermopolis, Garrison-Voltaire, Voltaire-Rugby, Rugby-Devils Lake, Devils Lake-Carrington, Carrington-Jamestown, Devils Lake-Lakota, and Jamestown-Valley City transmission lines), 43 miles of 69-kilovolt transmission lines (Leeds-Rolla) and 10 substations (Beulah, Miles City, Havre, Rudyard, Shelby, Thermopolis, Devils Lake, Rugby, Carrington, and Leeds), with a total capacity of 141,500 kilovolt-amperes were energized. In addition, Angostura Power Plant, supplying 1,200 kilowatts, was put into operation.

Thirty-five sale-of-power contracts and two memorandums of understanding were executed during the fiscal year. Total power revenues for fiscal year 1952 were $2,220,612, with generation of Federal hydroelectric plants in region 6 for which the Bureau markets the power amounting to 583.9 million kilowatt-hours. Comparable amounts for fiscal year 1951 were $1,550,736 and 430 million kilowatt-hours. The increases are due to the installation of an additional 35,000-kilowatt unit at Fort Peck and the start of production by Angostura Power Plant.

In fiscal year 1953, approximately 60 miles of 69-kilovolt, 905 miles of 115-kilovolt, and 163 miles of 230-kilovolt transmission lines are scheduled for energizing. Also, substations amounting to a capacity of approximately 200,000 kilovolt-amperes will be ready for use. Capacity of existing substations will be increased by about 20,000 kilovolt-amperes, and first-stage construction will be completed on approximately 12 substations whose ultimate capacity will be 385,000 kilovolt-amperes.

Region VII, Headquarters, Denver, Colo.

General investigations.—The investigation program for fiscal year 1952 included commitments for the completion of 10 reports, plus the Kirwin Definite Plan Report, which was added during the year. Of the 11 commitments, 7 were completed. These included the Acquisition of the North Platte Water Users Interests in the power system, the Missouri River Basin Power Survey, the Lower Platte River Basin Report, and definite-plan reports for the following units: Narrows, Sargent, Glendo, and Kirwin. The Niobrara River Basin preliminary report and the definite plan reports for Colorado-Big Thompson project, Bostwick division, and La Prele unit were not completed due to the imposition of additional work such as adjudication of water rights, requirement for additional data on land classification, emergency flood studies, and some local opposition to proposed development.

The Commissioner's proposed report for the Fryingpan-Arkansas project (formerly the Gunnison-Arkansas) was signed on August 27, 1951, approved and adopted by the Secretary, and sent to the President on October 19, 1951. These actions resulted in a tremendous demand from the people for immediate authorization, and it was placed before both houses during the last session of Congress.

Construction.—Construction contractors generally were not able to comply with their optimistic estimates of performance due to the difficulty of securing materials and equipment occasioned by limitations imposed by the DEPA and by the strike by steelworkers' unions. However, construction of irrigation and generation facilities scheduled was successfully prosecuted during the year and will result in increased capacity in future years.

Construction of the Narrows and Glendo Dams has again been delayed because of inability to resolve all problems with State and local groups. There were 96 different construction contracts in effect during the fiscal year representing a total estimated value of $89,000,000, of which $33,000,000 were completed during the fiscal year and on which $26,000,000 were earned by the contractors during the year. Of 251 major actions scheduled for completion, 218 were completed.

Completed contracts during the year included: Five contracts on the Superior canal, one on the Courtland canal, earthwork and bridge abutments for the Trenton Dam railroad relocation, development of Bonny Reservoir public-use area, Cedar Bluff Dam, Olympus, Pole Hill, and Rattlesnake tunnels, Carter Lake pressure tunnel, Windsor canal, and 24 contracts for transmission lines, substations, and other power features.

New contracts awarded during the year included the Franklin South Side pump plant canal and laterals, the Trenton Dam railroad bridge superstructures and road relocation, one contract each on the Cambridge canal and Cambridge laterals, foundation for the Kirwin Dam, Willow Creek pumping plant and canal, Pole Hill canal and penstocks, Rattlesnake Dam, Flatiron penstocks, Carter Lake pressure conduit, St. Vrain supply canal and tunnels, Flatiron section of the Horsetooth feeder canal, the Alcova power plant, Alcova Government housing and community facilities, Flatiron-Fort Collins-Cheyenne tap, Estes-Pole Hill 115-kilovolt transmission line, Fort Collins substation, Hanna-Sinclair and the Seminoe-Bairoil 34.5 transmission lines, Bairoil substation, Guernsey tap line, Sinclair substation and Julesburg rural substation. Irrigation districts under contract with the Government performed $730,000 worth of rehabilitation and betterment work on the North Platte project.

Operation and maintenance.—Full irrigation to some 7,000 acres of new land and a supplemental supply to 206,000 acres was provided by the completion of project works during the year. Court confirmation of the Kansas-Bostwick repayment contract and the Mirage Flats contract have been obtained. The total crop value of the region's irrigated lands was $87,308,829 for the calendar year 1951, of which $14,342,533 was from land receiving a full supply of irrigation water and $72,358,242 was from land receiving a supplemental supply of water from Reclamation works.

Power.—The 1952 schedules did not predict an increase of generating capacity. However, progress was made on generating facilities which will increase the region's capacity in future years, principal of these are the Alcova power plant on the Kendrick project and the Pole Hill and Flatiron power plants on the Colorado-Big Thompson project. Some difficulties in obtaining materials for power construction were experienced during the year. The seven hydroelectric power plants in the region with a generating capacity of 149,300 kilowatts generated 554,490,000 kilowatt-hours of electrical energy during the fiscal year which were sold to municipalities, REA cooperatives, industrial plants, and public utilities for a gross revenue of $3,293,119.01.

Alaska District, Headquarters, Juneau, Alaska

General Investigations.—A report on Swan Lake, a 13,500-kilowatt hydroelectric power project near Ketchikan, Alaska, was favorably submitted by the Commissioner to the Secretary for action. At the end of the fiscal year the report was being reviewed by interdepartmental agencies before sending to the Bureau of the Budget. The power plant would supply 71,000,000 kilowatt-hours of firm energy and 8,800,000 kilowatt-hours of nonfirm energy to the power deficient Ketchikan area. Also in southeast Alaska, field investigations were initiated on Blue Lake project near Sitka. Not only would the project serve the city of Sitka, the Mount Edgecumbe Hospital, and the vocational training school of Alaska Native Service on nearby Japonski Island, but would also serve a proposed wood-pulp industry with both electric energy and industrial process water. Project studies are scheduled for completion in fiscal year 1953. In the Fairbanks area, Wickersham project investigation was held up pending completion of topography. This project has been shelved until the alternate Devil Canyon project in Susitna River basin is more thoroughly investigated. Susitna River basin studies were concluded after 3 years of field work. A report, to be issued in August 1952, will disclose several low-cost power potentialities that could be developed to serve the entire railbelt from Seward to Fairbanks.

Construction.—Eklutna, the only Bureau of Reclamation project under construction in the Territory of Alaska was approximately 20 percent complete on June 30, 1952. It is located 34 miles north of Anchorage. A transmission line is being constructed northward to serve Matanuska Valley, the city of Palmer, and several coal mines. A transmission line under construction southward will serve Elmendorf Air Force Base, Fort Richardson, the city of Anchorage, and adjacent areas.

The percent completion at the end of the fiscal year for major construction items was as follows: 12 permanent residences, 30 temporary residences, streets, and utilities 96 percent complete; warehouse 99 percent complete; 4½-mile tunnel, intake structure, alterations to existing dam, surge tank, and penstock excavation, 22 percent complete; Eklutna-Palmer 115-kilovolt transmission line 62 percent complete; and Eklutna-Anchorage 115-kilovolt transmission line 9 percent complete. Total expenditures to June 30, 1952, were $6,620,488. In fiscal year 1953 appropriation of $13,000,000 was made available by Congress for continuing construction. All major construction contracts have been awarded with the exception of the Anchorage substation scheduled for award in September 1952. The power shortage in the area is so critical, work is being expedited so at least one 15,000-kilowatt generator will be producing energy in April 1954, although the entire plant of 30,000 kilowatts probably will not be finished until September 1954.

An Appraisal Board was appointed by Secretary Chapman, with the approval and concurrence of the Department of Justice, to determine the value of the small existing Eklutna power plant now owned by the city of Anchorage. The Board prepared a report on its findings, and early in fiscal year 1953 an offer will be made to the city of Anchorage to acquire its interest in these facilities for operation in conjunction with the Bureau's Eklutna project.

Operation and Maintenance.—On May 23, 1952, Under Secretary Searles transferred operation and maintenance responsibilities of Knik Arm steam power plant from the Alaska Railroad to Bureau of Reclamation. The plant being built in Anchorage by the Alaska Railroad and Chugach Electric Association will have 11,200 kilowatts of capacity and is scheduled for completion in November 1952. The power plant personnel will comprise operating, maintenance, and administrative personnel. A personnel ceiling of 36 has been requested to facilitate this new activity.

DIVISION OF WATER AND POWER

Reginald C. Price, Director

During most of fiscal year 1952, the Division of Water and Power functioned as a staff agency in the office of the Under Secretary of the Interior. The principal duties of the Division of Water and Power are to assist in establishing and clarifying departmental policy and to provide expert technical advice in the filed of water and power developments.

The principal power marketing agencies of the Department are the Bureau of Reclamation, which also reclaims the arid and semi-arid lands of the West and produces electrical energy at some of its own projects; the Bonneville Power Administration; the Southwestern Power Administration; and the Southeastern Power Administration. These agencies market power produced at projects of the Bureau of Reclamation and the Corps of Engineers of the Department of the Army in excess of project requirements.

The Department continued to market power under policies laid down by Congress. These policies require that preference shall be given to public bodies and cooperatives and that power shall be sold at rates which will encourage the most widespread use at the lowest possible rates consistent with sound business principles. During fiscal year 1952, Interior Department agencies marketed 30,404 million kilowatt hours for which $79,476,536 were received in revenues at an average price of 2.61 mills per kilowatt hour marketed. The attached table prepared on a consolidated basis shows for fiscal year 1952 the installed capacity of plants whose power is marketed by Interior Department agencies, the net energy generated by these plants, the energy marketed, and the gross revenues for marketed power.

During the year the Department, through the Division of Water and Power, reviewed 19 reports of the Corps of Engineers of the Department of the Army concerned primarily with flood control and navigation; 12 reports of the Department of Agriculture concerned primarily with run-off and water flow retardation; and 9 reports of the Bureau of Reclamation concerned primarily with irrigation, power, and municipal and industrial water supply. Total construction cost to the Federal Government of these Federal projects was estimated at over 1 billion dollars. The Department also reviewed, through the Division of Water and Power, 48 applications for power permits and licenses referred for comment to the Department by the Federal Power Commission.

Members of the staff of the Division of Water and Power represent the Department on the Energy Conversion and the Benefits and Costs subcommittees of the Federal Inter-Agency River Basin Committee, and the Interdepartmental Radio Advisory Committee.

The Division of Water and Power coordinated the efforts of Geological Survey, Bureau of Reclamation, Bureau of Indian Affairs, Fish and Wildlife Service, Bureau of Land Management, and National Park Service in the preparation of an analysis of the drought situation in the Southwest. This report, published by the Department in December 1951, evaluated the effect of the drought on the local economy and on the Department's programs, summarized the steps which had been taken to alleviate the situation, and outlined recommendations which, if adopted, would tend to increase or conserve vital water supplies.

Technical assistance was given the Office of Territories in connection with their plans and proposals for the expansion of electric facilities in the Virgin Islands, Alaska, and the Pacific Islands. The Division's technicians also gave substantial advice and assistance to the Department of Justice in connection with two cases pending before the United States Supreme Court involving the use of public lands under the jurisdiction of the Secretary of the Interior for the construction of transmission lines by private power companies.

During fiscal year 1952, approximately 190 radio frequencies were assigned to various offices and agencies of the Department. At the end of fiscal year 1952, the Department had over 5,000 fixed stations operating on about 250 different frequencies.

POWER MARKETING DATA, FISCAL YEAR 1952

Marketing agency	Installed generator capacity, nameplate rating June 30, 1952[1]	Net energy generated 12 months ending June 30, 1952	Energy marketed 12 months ending June 30, 1952	Gross revenues from sale of power 12 months ending June 30, 1952	Average revenue per kilowatt-hr. marketed 12 months ending June 30, 1952
	Kilowatts	*Kilowatt-hrs.*	*Kilowatt-hrs.*	*Dollars*	*Mills per kw.-hr.*
Bureau of Reclamation	4, 266, 200	26, 065, 609, 702	[2] [6] 11, 251, 657, 910	[3] 32, 210, 035	[4] 2. 86
Bonneville Power Administration	[5] 518, 400	[5] 4, 462, 935, 000	[6] 17, 022, 997, 569	39, 345, 831	2. 31
Southeastern Power Administration	425, 600	1, 602, 355, 900	1, 595, 048, 200	5, 285, 476	3. 31
Southwestern Power Administration	157, 000	524, 012, 130	[6] 533, 932, 887	2, 635, 194	4. 94
Total	5, 367, 200	32, 654, 912, 732	[6] 30, 403, 636, 566	79, 476, 536	2. 61

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[1] Includes capacity in Corps of Engineers flood control projects.

[2] Excludes 14,080,546,400 kwh delivered at Grand Coulee Dam to Bonneville Power Administration which is marketing agent for this power.

[3] Excludes $11,100,000 revenues from Bonneville Power Administration for power delivered at Grand Coulee Dam.

[4] The average revenue per kwh sold, including disposition to Bonneville Power Administration, is 1.71 mills.

[5] Corps of Engineers' Bonneville plant only.

[6] Includes purchased power.

BONNEVILLE POWER ADMINISTRATION

Paul J. Raver, Administrator

FINANCIAL RESULTS OF OPERATIONS

Excellent water conditions during the fiscal year ending June 30, 1952, and a continuation of heavy demands for power from defense industries and distributors combined to boost gross revenues of the Columbia River power system to a new peak of $40,180,146, an increase of $3,991,118 or 11 percent over the previous year. Net revenues, after repayment of all expenses for operation, maintenance, administration, marketing, depreciation, and interest were $15,890,642, a gain of $1,395,090 or 9.6 percent over 1951.

The net revenues for 1952 would have been $311,147 greater except for an important change in accounting policy adopted by the Bonneville Power Administration for 1952 to reflect in its accounts the share applicable to its activities of the estimated costs to the Federal Government of the civil-service retirement system. As indicated in the summary table of revenues and expenses, an adjustment was also made for the estimated retirement system costs for prior years in the amount of $1,451,593, including compound interest on prior years' charges, reducing the net results for the year carried to accumulated net revenues to $14,439,049. In addition to these pension cost charges against net revenues, the new accounting policy increased the capital investment or plant account by $2,645,782 consisting of $541,904 for 1952 and $2,103,878 for prior years. The grand total adjustment, made only in the accounts of the Bonneville Power Administration and not in the accounts of the two generating projects, was $4,408,522.

Net revenues carried to accumulated surplus net revenues were $14,439,049 in 1952 after the prior years' pension charges adjustment, and brought the total net as of June 30, 1952, to $83,578,662. The Administration anticipates further increases in gross operating revenues in 1953 but a decline in net revenues. New projects, Hungry Horse, Albeni Falls, and Detroit, will be in partial operation in fiscal year 1953. The added generation will contribute gross revenues, but will reduce net revenues since these projects have been constructed at higher costs than the existing dams and they will be only partially completed. Moreover, costs generally for labor and supplies have risen in recent years. However, no increases have been made in the Administration's basic power rates since their adoption in 1938.

TABLE I.—Columbia River power system—condensed summary of revenues and expenses

	Fiscal year 1951	Fiscal year 1952	Total to June 30, 1952
Operating revenues	$36,189,028	$40,180,146	$265,253,885
Expenses of operation, maintenance, etc.	8,657,494	9,367,657	70,846,950
Provision for depreciation	6,496,777	7,147,815	44,788,565
Interest expense	6,532,009	7,608,214	63,317,674
Miscellaneous deductions, net	7,196	165,818	1,270,441
Total deductions	21,693,476	24,289,504	180,223,630
Surplus net revenues from power operations	14,495,552	15,890,642	85,030,255
Adjustment for prior years' pension costs		1,451,593	[1] 1,451,593
Amount carried to accumulated net revenues		14,439,049	83,578,662

[1] Includes $1,117,173 for direct charges to operation and maintenance plus $334,420 interest expense. Hence, cumulative expenses of operation, etc., shown above as $70,846,950 become $71,964,123 and the cumulative interest expense figure of $63,317,674 becomes $63,652,094.

Summary of Revenues

Revenue trends by customer categories are summarized in table II. Aluminum with 33.29 percent and other industries, 11.57 percent, accounted for nearly one-half or 45.86 percent of gross for 1952. Publicly-owned utilities ranked second with about one-third or 32.29 percent and privately owned utilities followed with about one-fifth or 21.22 percent.

Sales to the aluminum industry decreased slightly $147,069 or 1.1 percent, due principally to a brief curtailment of operations at the Reynolds plant at Longview for rehabilitation purposes necessitated by an expansion program. Other industrial sales were up $875,220 or 23.2 percent, representing increased usage by Chromium Mining and Smelting Corp. and the Atomic Energy Commission plus a new customer, Victor Chemical Works.

TABLE II.—Revenues by class of customer through fiscal year 1952

Class of customer	1947 and prior	1948	1949	1950	1951	1952	Total to June 30, 1952	1952 percentage (dollar revenue)
Industry:								
Aluminum	$53, 221, 355	$10, 453, 425	$11, 741, 530	$12, 133, 254	$13, 523, 276	$13, 376, 207	$114, 449, 047	33. 29
Other [1]	14, 302, 061	1, 915, 884	2, 219, 819	2, 677, 580	3, 774, 705	4, 650, 425	29, 540, 474	11. 57
Publicly owned utilities	10, 400, 864	4, 318, 120	5, 893, 436	8, 409, 428	9, 947, 909	12, 973, 025	51, 942, 782	32. 29
Privately owned utilities	23, 241, 566	7, 633, 051	7, 756, 301	7, 587, 963	8, 525, 609	8, 526, 775	63, 271, 265	21. 22
Other operating revenue	4, 186, 610	193, 230	209, 943	389, 291	417, 529	653, 714	6, 050, 317	1. 63
Total operating revenue	105, 352, 456	24, 513, 710	27, 821, 029	31, 197, 516	36, 189, 028	40, 180, 146	265, 253, 885	100. 00

[1] Includes federal agencies.

Sales to publicly owned utilities gained $3,025,116 or 30.4 percent. This gain resulted in large part from general growth in the regional power requirements plus a few special factors such as increased sales of about $900,000 to City Light of Seattle, largely as a result of the city's acquisition of properties of Puget Sound Power & Light Co. Sales to privately owned utilities remained almost unchanged in total, but increased sales to companies other than Puget were offset by the transfer by the latter of its Seattle properties to the city of Seattle.

Repayment of Federal Investment

All funds required for construction of plant, for working capital costs and materials and for miscellaneous assets are obtained from congressional appropriations, directly or indirectly, except for a small amount obtained from power sales through a continuing fund available to insure continuous operation or to meet emergencies. All receipts from sales or other sources are returned to the Treasury, except for the small amounts transferred to the continuing fund. Interest at 2½ percent per year is computed on the net balance and is added to and becomes a part of the gross investment of the Federal Government. Details of the interest accumulation are given in table III. Table IV summarizes the Federal investment.

TABLE III.—Columbia River power system—Summary of interest[1] on Federal investment as of June 30, 1952

Interest during construction—to be returned during repayment period as part of the Federal investment:		
Transmission system	$3,012,802.81	
Bonneville Dam project	2,331,652.95	
Columbia Basin project	9,718,739.70	
Subtotal		$15,063,195.46
Interest on costs of Columbia Basin project allocated to future river regulation—to be returned as part of repayment of future down-stream projects		10,318,658.93
Interest charged to operations—repaid currently:		
Transmission system	$21,923,366.93	
Bonneville Dam project	16,033,343.59	
Columbia Basin project	25,695,383.95	
Subtotal		63,652,094.47
Gross interest accumulation		89,033,948.86

[1] Computed at the rate of 2½ percent per year.

Receipts of $251,845,393 have repaid all the current expenses for operation, maintenance, interest, and miscellaneous items and have left a remainder of $123,005,866 in repayment of the capital investment. This repayment has reduced the net unpaid Federal investment to $410,857,174 and represents the return to the Treasury of 23 percent of the gross capital investment of $533,863,040, consisting primarily of electric utility plant which is shown in table V. The repayment is substantially greater than required to meet scheduled return of capital costs.

TABLE IV.—Columbia River power system—Summary of Federal investment and repayment as of June 30, 1952

	Gross investment	Repayments	Net investment
Investment in expenses of operation, maintenance, etc.:			
From congressional appropriations—direct	$62, 221, 180		
From congressional appropriations—indirect [1]	2, 790, 049		
From power sales receipts—continuing fund	176, 204		
Total for operation, maintenance, etc	65, 187, 433	$65, 187, 433	0
Investment in interest expense [2]	63, 652, 094	63, 652, 094	0
Total current expense	128, 839, 527	128, 839, 527	0
Investment in capital costs (plant, working capital, etc.): [3]			
From congressional appropriations—direct	452, 827, 165		
From congressional appropriations—indirect:			
Allotments from PWA funds	43, 200, 800		
WPA expenditures	6, 674, 130		
Other [1]	4, 692, 691		
Interest on Federal investments [2]	25, 381, 854		
From power sales receipts—continuing fund	1, 086, 400		
Total capital investment of the Federal Government	533, 863, 040	123, 005, 866	410, 857, 174
Total current expense and capital costs	662, 702, 567	251, 845, 393	410, 857, 174

[1] Goods and services received from, net of amounts furnished to, other Federal agencies without transfer of funds.

[2] The Columbia River power system does not pay interest from its appropriations but imputes interest expense at 2½ percent per year and returns receipts to the Treasury in repayment of such costs.

[3] Consists of utility plant of $515,602,079, cash (including a $500,000 balance in the continuing fund), materials, etc.

TABLE V.—Columbia River power system—Summary of plant accounts as of June 30, 1952

	Total	Allocation	
		Nonpower	Power
Bonneville Power Administration	$249, 039, 489		$249, 039, 489
Bonneville Dam project	86, 773, 504	$27, 266, 273	59, 507, 231
Columbia Basin project	445, 222, 773	238, 167, 414	207, 055, 359
Total	781, 035, 766	265, 433, 687	[1] 515, 602, 079
Less combined reserve for depreciation			44, 623, 044
Total less reserve			470, 979, 035

[1] As of June 30, 1952, the gross Federal investment in power plant and other power capital items was $533,863,040 consisting of the $515,602,079 investment in plant (dams, power plants, transmission facilities, etc.) plus cash, materials, supplies and miscellaneous. Of the gross capital investment, $123,005,866 (23.0 percent) had been repaid to the U. S. Treasury from cash receipts after meeting all expenses for operation, maintenance, and interest, leaving an unpaid balance of $410,857,174.

On an individual project basis, the return of the power capital investment has been as follows:

	Gross power capital investment	Repaid as of June 30, 1952		Net power investment
			Percent	
Bonneville Power Administration	$255, 557, 049	$67, 552, 561	26. 4	$188, 004, 488
Bonneville Dam project	59, 874, 490	18, 699, 654	31. 2	41, 174, 836
Columbia Basin project	218, 431, 501	36, 753, 651	16. 8	181, 677, 850
Total	533, 863, 040	123, 005, 866	23. 0	410, 857, 174

The foregoing data on repayment of the investment are based on the certified cost accounts maintained in accordance with the Federal Power Commission uniform system of accounts. On a statutory repayment basis, results are the same for the Bonneville Power Administration and Bonneville Dam, but different for the Columbia Basin project since in the case of the latter (1) power revenues must pay operation and maintenance costs of Grand Coulee Dam and power plant allocated to irrigation, (2) interest expense is computed at 3 percent rather than 2½ percent, and (3) other differences such as the exclusion of interest during construction in the pay-out accounts of the Columbia Basin project. Although final data are not available, the additional costs for expenses and interest to be paid from power revenues were approximately $2,001,000 for operation and maintenance and $4,838,000 for interest to June 30, 1952.

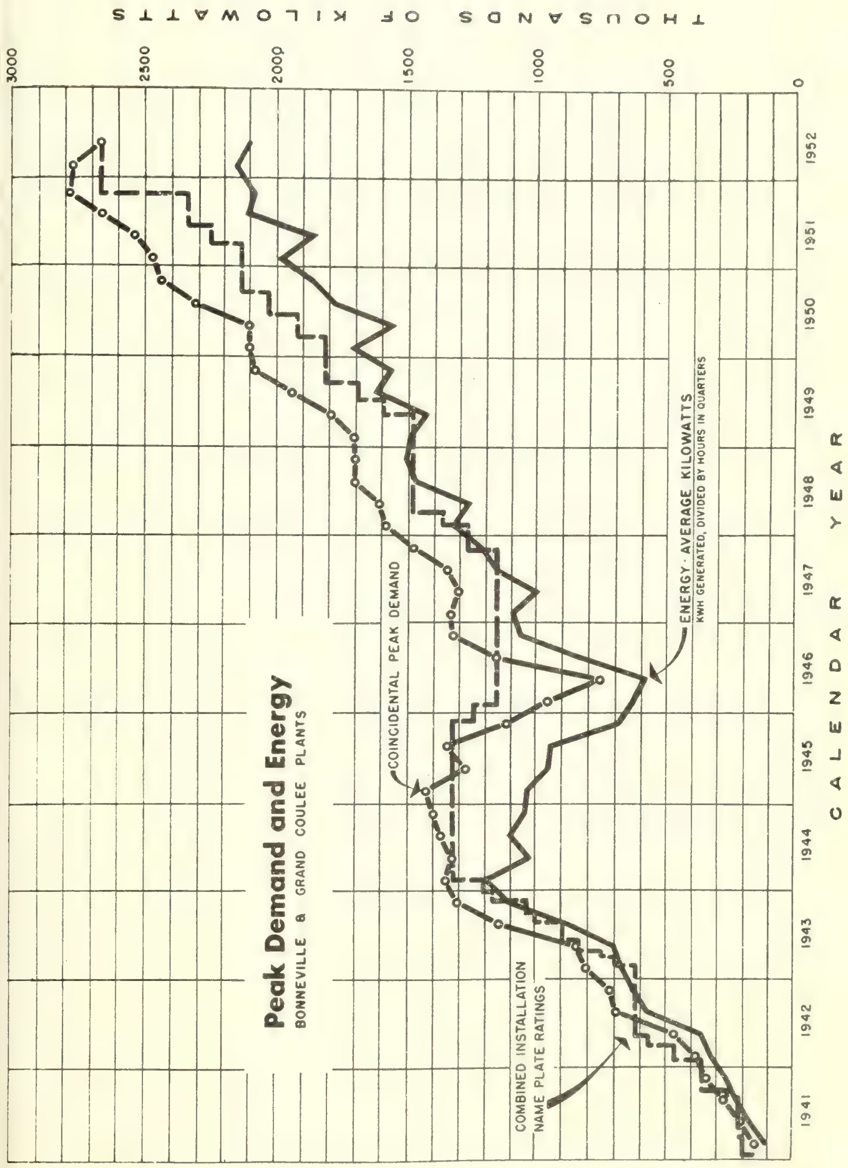
SUMMARY OF OPERATIONS

Energy Production

Power generated at Bonneville and Grand Coulee power plants for the Administration exceeded 18.5 billion kilowatt-hours of electric energy during fiscal year 1952. This was more than 60 percent of all power produced in the Pacific Northwest during the year. Power produced during the fiscal year brought total production from the two Columbia River plants since July 1939 to 115.6 billion kilowatt-hours and reflected an increase of 12.6 percent over fiscal year 1951.

New System Peak

A new system peak was recorded between 5 and 6 p. m., December 31, 1951, with a coincidental demand on Bonneville and Grand Coulee plants of 2,784,000 kilowatts, a 10-percent increase over the previous fiscal year's maximum demand of 2,535,000 kilowatts, occurring during June 1951.



Peak Demand and Energy

BONNEVILLE & GRAND COULEE PLANTS

TABLE VI.—Generation at Bonneville and Grand Coulee plants for Bonneville Power Administration, fiscal years 1939–52

[Thousands of kilowatt-hours]

Fiscal years ending June 30	Bonneville generation	Grand Coulee generation	Total generation for BPA
1939	34, 874		34, 874
1940	208, 426		208, 426
1941	894, 177	7. 455	901, 632
1942	1, 807, 309	741, 844	2, 549, 153
1943	2, 801, 480	2, 816, 956	5, 618, 436
1944	3, 488, 874	5, 750, 950	9, 239, 824
1945	3, 391, 128	5, 660, 446	9, 051, 574
1946	2, 674, 834	3, 561, 329	6, 236, 163
1947	3, 695, 255	5, 058, 482	8, 753, 737
1948	3, 991, 860	[1] 6, 894, 047	10, 885, 907
1949	3, 868, 558	[1] 9, 057, 230	12, 925, 788
1950	3, 689, 309	[1] 10, 451, 524	14, 140, 833
1951	3, 793, 276	[1] 12, 679, 108	16, 472, 384
1952	4, 462, 935	[1] 14, 092, 466	18, 555, 401
Total	38, 802, 295	[1] 76, 771, 837	115, 574, 132

[1] Includes energy transferred for Bureau of Reclamation.

Since the fall of 1946, maximum system demands have continuously exceeded the nameplate rating of installed generators. Energy production by years at Bonneville and Grand Coulee plants is shown in table VI, with peak demand and energy data in chart 1. Prepared on a quarterly basis the chart shows clearly the general trends of Bonneville Power Administration system growth and development.

Energy Receipts and Deliveries

Bonneville Power Administration's transmission grid forms the backbone of the interconnected transmission system of public and private utilities in the Pacific Northwest. As a result electric energy receipts and deliveries on Bonneville's transmission system cover many complex transactions in addition to receipts from Bonneville and Grand Coulee generation, and deliveries by sales.

The integrated transmission grid makes possible the fullest utilization of power facilities in the area through diversity in peaking and water capabilities and diversity of system load conditions. Substantial quantities of energy are received and delivered as transfers from other utilities.

Transactions also involve storage by the Administration in non-Federal reservoirs as well as storage by non-Federal utilities in the Grand Coulee reservoir. Disposition of energy includes deliveries from storage in Grand Coulee or to storage in other reservoirs, energy transfers for the Bureau of Reclamation from Grand Coulee, energy used by the Administration and energy losses in transmission and transformation.

Table VII, electric-energy account, summarizes energy receipts and deliveries.

TABLE VII.—Electric energy account, fiscal year ended June 30, 1952

Energy received (thousands of kilowatt-hours):	
Energy generated for Bonneville Power Administration:	
Bonneville	4, 462, 935
Grand Coulee	[1] 14, 092, 466
Total	[1] 18, 555, 401
Power purchased and interchanged in	1, 119, 425
Total received	19, 674, 826
Energy delivered (thousands of kilowatt-hours):	
Sales	17, 022, 998
Power interchanged out	[1] 1, 076, 574
Used by Administration	19, 376
Total delivered	18, 118, 948
Energy losses in transmission and transformation	1, 555, 878
Losses as percent of total energy received ..... percent	7. 9
Maximum demand on Bonneville and Grand Coulee plants (kilowatts):	
Dec. 31, 1951, 5–6 p. m. Pacific standard time	2, 784, 000
Load factor, total generated for Bonneville Power Administration ..... percent	75. 9

[1] Includes energy transferred for Bureau of Reclamation.

Sales Exceed 17 Billion Kilowatt-Hours

Energy sales to customers of the Bonneville Power Administration exceeded 17 billion kilowatt-hours during fiscal year 1952, an increase of 12.9 percent over the previous year. Energy losses in transmission and transformation of power were 1.6 billion kilowatt-hours, or 7.9 percent of total energy received on the system.

Critical water conditions existing last fall made curtailment of power to aluminum plants and other large industries necessary, with some curtailment during peaking periods being necessary during 8 months of the year. As a result of a brief shutdown at the Longview Reynolds plant for construction, and critical water conditions, 1 percent less energy was sold to aluminum plants than during the previous fiscal year. Deliveries to all other classes of customers showed increases with the largest being in deliveries to public utilities, an increase of 41 percent. Firm energy deliveries to private utilities increased 6 percent; industries other than aluminum, 37 percent; and Federal agencies 17 percent.

Composite Average Rate 2.41 Mills

The Administration has delivered 107,480,705,000 kilowatt-hours of energy at a composite average rate of 2.41 mills per kilowatt-hour during the 14 years of operation ending June 30, 1952. Sales to publicly owned utilities for this period were 18.5 billion kilowatt-hours at an average rate of 2.80 mills. Privately owned utilities received 26.7 billion kilowatt-hours at an average rate of 2.37 mills, and industries 62.3 billion kilowatt-hours at an average rate of 2.31 mills. Power sales to the aluminum plants initially established in the Pacific Northwest to meet World War II production needs and expanded to meet current requirements, were 52.2 billion kilowatt-hours at an average rate of 2.20 mills. Sales to industries other than aluminum including sales to Federal agencies were 10 billion kilowatt-hours at an average rate of 2.91 mills. Since 1942 the proportion of energy sales delivered to aluminum plants with high-load-factor usage of electric energy, has been decreasing, resulting in a tendency toward higher average mills per kilowatt-hour. Increasing load factors developed by other customers made possible by favorable stream flows during the past fiscal year except for a short period last fall, have counterbalanced this tendency in fiscal year 1952 to give 2.31 mills per kilowatt-hour, as compared to 2.37 and 2.38 mills per kilowatt-hour for the previous two fiscal years. The same set of rate schedules, based on $17.50 a kilowatt-year, is available to all customers, but the average rate varies according to the customer's system load conditions and the rate schedules best adapted to those load conditions.

Electric energy sales by class of customer for each of the 14 years' operation are shown in table VIII. Detail of energy deliveries to these four classes of customers is shown in chart 2. The relative size and growth of energy sales to aluminum plants, other industries, privately owned utilities, and publicly owned utilities is shown in the chart while detail by customers of energy sales during fiscal year 1952 is shown in table IX.

TABLE VIII.—Electric energy sales by class of customer, fiscal years 1939–52

[Thousands of kilowatt-hours]

Fiscal years ending June 30	Industry		Publicly owned utilities	Privately owned utilities	Total
	Aluminum	Other industries[1]			
1941 and prior	522, 982	4, 829	35, 242	536, 555	1, 099, 608
1942	1, 845, 249	79, 155	142, 491	357, 704	2, 424, 599
1943	3, 588, 848	507, 196	435, 289	739, 076	5, 270, 409
1944	5, 453, 893	1, 022, 477	727, 642	1, 467, 304	8, 671, 316
1945	4, 667, 381	964, 724	823, 822	2, 057, 203	8, 513, 130
1946	2, 492, 985	799, 378	635, 531	1, 902, 990	5, 830, 884
1947	4, 212, 413	626, 688	1, 044, 784	2, 377, 887	8, 261, 772
1948	4, 902, 465	646, 913	1, 560, 754	3, 180, 993	10, 291, 125
1949	5, 665, 746	881, 454	2, 079, 290	3, 343, 983	11, 970, 473
1950	5, 863, 465	1, 023, 830	2, 840, 021	3, 318, 719	13, 046, 035
1951	6, 544, 703	1, 537, 580	3, 413, 487	3, 582, 586	15, 078, 356
1952	6, 471, 694	1, 941, 968	4, 803, 357	3, 805, 979	17, 022, 998
Total to June 30, 1952	52, 231, 824	10, 036, 192	18, 541, 710	26, 670, 979	107, 480, 705

[1] Includes Federal agencies.

TABLE IX.—Energy deliveries to customers of the Bonneville Power Administration, fiscal year ended June 30, 1952

CUSTOMERS

	Energy deliveries for year [1] *(kilowatt-hours)*
Publicly owned utilities:	
Municipalities:	
Bandon, Oreg	8,352,000
Canby, Oreg	8,064,000
Cascade Locks, Oreg	7,382,400
Centralia, Wash	6,683,000
Cheney, Wash	10,400,287
Drain, Oreg	6,948,000
Ellensburg, Wash	25,939,680
Eugene, Oreg	64,712,639
Forest Grove, Oreg	27,547,488
Grand Coulee, Wash	18,993,600
McCleary, Wash	12,849,600
McMinnville, Oreg	40,284,200
Milton, Oreg	12,432,000
Monmouth, Oreg	7,946,370
Seattle, Wash	874,328,172
Springfield, Oreg	12,955,200
Tacoma, Wash	820,503,000
Total municipalities (17)	1,966,321,736
Public utility districts:	
Benton County public utility district No. 1	75,599,654
Central Lincoln public utility district	82,602,400
Chelan County public utility district No. 1	245,608,818
Clallam County public utility district No. 1	65,566,136
Clark County public utility district No. 1	314,633,300
Clatskanie public utility district	11,959,200
Cowlitz County public utility district No. 1	303,073,084
Douglas County public utility district No. 1	57,586,700
Ferry County public utility district No. 1	568,504
Franklin County public utility district No. 1	53,412,000
Grant County public utility district No. 2	120,291,240
Grays Harbor County public utility district No. 1	181,082,088
Kittitas County public utility district No. 1	5,074,500
Klickitat County public utility district No. 1	36,988,278
Lewis County public utility district No. 1	88,478,770
Mason County public utility district No. 3	88,504,800
Northern Wasco County public utility district	6,998,400
Okanogan County public utility district No. 1	66,149,583
Pacific County public utility district No. 2	53,295,145
Pend Oreille County public utility district No. 1	33,573,301
Skamania County public utility district No. 1	16,448,800
Snohomish County public utility district No. 1	446,597,194
Tillamook public utility district	37,556,200
Wahkiakum County public utility district No. 1	9,823,671
Total public utility districts (24)	2,401,471,766

See footnote at end of table.

TABLE IX.—Energy deliveries to customers of the Bonneville Power Administration, fiscal year ended June 30, 1952—Continued

CUSTOMERS—continued

	Energy deliveries for year[1] *(kilowatt-hours)*
Cooperatives:	
Benton Lincoln Electric Cooperative	64, 069, 710
Benton Rural Electric Association	22, 752, 973
Big Bend Electric Cooperative	15, 783, 232
Blachly-Lane County Electric Cooperative	8, 610, 000
Central Electric Cooperative	7, 397, 560
Chelan County Electric Cooperative	600, 600
Clearwater Valley Light and Power Association	23, 336, 300
Columbia Basin Electric Cooperative	4, 772, 400
Columbia County REA	11, 780, 950
Coos-Curry Electric Cooperative	8, 346, 000
Douglas Electric Cooperative	22, 194, 632
Eastern Oregon Electric Cooperative	1, 033, 800
Hood River Electric Cooperative	8, 944, 800
Idaho County Light and Power Association	5, 914, 350
Inland Empire REA	46, 840, 300
Kootenai County REA	7, 692, 730
Lane County Electric Cooperative	27, 983, 712
Lincoln Electric Cooperative—Montana	1, 912, 800
Lincoln Electric Cooperative—Washington	11, 806, 039
Missoula Electric Cooperative	3, 328, 544
Nespelem Valley Electric Cooperative	4, 924, 000
Northern Lights	7, 133, 440
Okanogan County Electric Cooperative	2, 458, 750
Orcas Power and Light Co	2, 502, 720
Pend Oreille Electric Cooperative	4, 642, 107
Ravalli Electric Cooperative	3, 845, 880
Salem Electric Cooperative	27, 776, 800
Sandy Electric Cooperative	2, 035, 836
Stevens Co. Electric Cooperative	15, 956, 000
Tanner Mutual Power and Light Association	243, 099
Umatilla Electric Cooperative	15, 961, 555
Wasco Electric Cooperative	16, 739, 122
West Oregon Electric Cooperative	11, 803, 355
Total cooperatives (33)	421, 124, 096
Other:	
Oregon State College	18, 720
Vanport Extension Center	621, 720
Vera irrigation district No. 15	13, 798, 400
Total other (3)	14, 438, 840
Total publicly owned utilities	4, 803, 356, 438

See footnote at end of table.

ABLE IX.—Energy deliveries to customers of the Bonneville Power Administration, fiscal year ended une 30, 1952—Continued

CUSTOMERS—continued

	Energy deliveries for year [1] *(kilowatt-hours)*
Privately owned utilities:	
British Columbia Electric Ry. Co	61,000
California Oregon Power Co	13,721,781
Montana Power Co	39,990,261
Interconnected Pool [2]	599,558,284
Mountain States Power Co	174,785,928
Pacific Power and Light Co.—Astoria	------------
Pacific Power and Light Co.—Astoria and main system	721,120,000
Portland General Electric Co	1,445,932,000
Puget Power and Light Co	238,597,000
Washington Water Power Co.-Pacific Power and Light Co	------------
Washington Water Power Co	273,557,000
Washington Water Power Co.—Kootenay Lake	298,656,000
Total privately owned utilities (8)	3,805,979,254
Federal agencies (12)	919,699,041
Industries:	
Aluminum:	
Aluminum Co. of America:	
Vancouver plant	1,479,768,269
Wenatchee plant	3,132,000
Kaiser Aluminum & Chemical Corp.:	
Spokane Aluminum Fabrication	225,287,505
Spokane Aluminum Reduction	2,477,028,973
Tacoma Aluminum Reduction	441,662,981
Reynolds Metals Co.:	
Longview plant	486,391,240
Troutdale plant	1,358,422,548
Other:	
Carborundum Co	88,410,000
Crown Zellerbach Corp	111,462,045
Electro Metallurgical Co	129,113,528
General Services Administration	311,413,575
Keokuk Electro Metals Co	131,030,104
Pacific Carbide & Alloys Co	37,653,931
Pennsylvania Salt Manufacturing Co	134,596,084
Rayonier Corp	22,364,628
Victor Chemical Works	56,225,425
Total industries (16)	7,493,962,836
Total sales of electric energy (113) [3]	17,022,997,569

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[1] Includes energy deliveries carried on exchange accounts.

[2] Includes Mountain States Power Co., Pacific Power & Light Co., Portland General Electric Co., Puget Sound Power & Light Co., and Washington Water Power Co.

[3] 112 customers as of June 30, 1952; service to 1 customer discontinued during year.

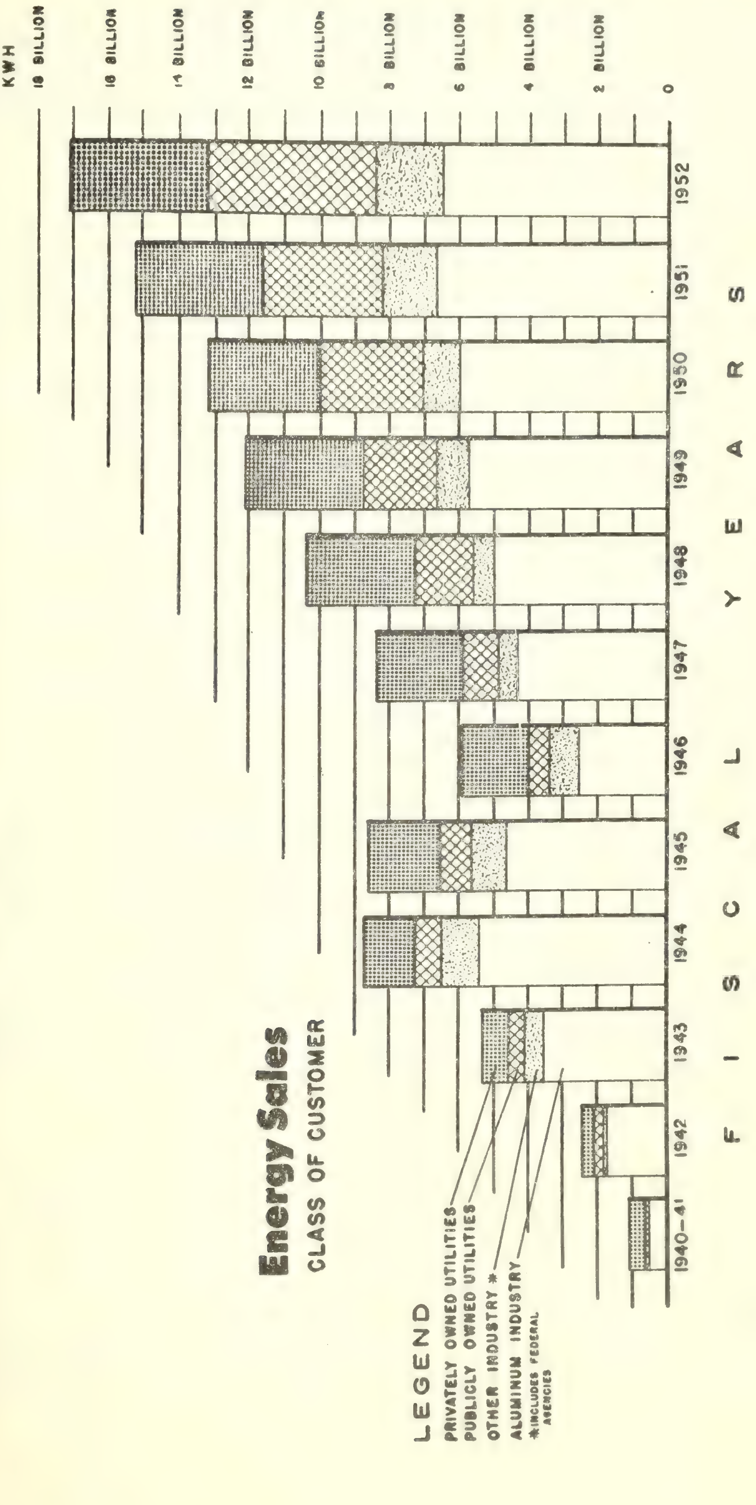
Rate Schedules Summarized

A sales summary for fiscal year 1952, classified by rate schedules, is shown in table X. Over three-fourths of energy sales during the fiscal year were made under the C schedule at an average rate of 2.09 mills. This is the kilowatt-year rate for firm power delivered anywhere from the transmission system and is also used with special measured demand provisions for sales of interruptible power. Sales are generally made under this rate to industries operating at high load factor and to utilities having substantial generating facilities. Other sales were made principally under the E schedule to utilities purchasing all or substantially all of their power requirements from the Administration. Sales under the F schedule were made to the utilities and industries requiring power at low load factor use and under the H schedule for dump, exchange, or experimental purposes.

During an emergency at Grand Coulee on March 14, the Administration purchased steam generated power. The bulk of this power was resold at cost, 8.61 mills per kwh, to Bonneville customers and the remainder was used to satisfy the Administration's firm commitments.

Customers Served

Customers served by the Administration at the end of the fiscal year totaled 112, including 76 public-owned distributors of power, 16 industrial customers, 12 Federal agencies, and 8 privately owned utilities. Five customers were added during the year—the Orcas Power & Light Cooperative, Aluminum Co. of America at Wenatchee, Victor Chemical Works at Silver Bow, the United States Indian Service, and a radio station of the United States Navy. Service to Oregon State College was discontinued.



Energy Sales

CLASS OF CUSTOMER

TABLE X.—Electric energy sales by rate schedules, fiscal year ended June 30, 1952

Rate schedule	Energy (thousands of kilowatt-hours)	Revenue [1]	Mills per kilowatt-hour
C-3, C-4:			
Industries	7,881,460	$16,291,322	2.07
Utilities	5,148,515	10,937,770	2.12
Subtotal	13,029,975	27,229,092	2.09
F-2, F-3, F-3:			
Industries	250,325	895,966	3.58
Utilities	84,321	341,854	4.05
Subtotal	334,646	1,237,820	3.70
A-4: Utilities	21,108	70,025	3.32
E-3, E-4: Utilities	2,512,147	7,973,051	3.17
Experimental steam, H-2, H-3, and exchange (industries and utilities)	1,125,122	2,835,843	2.52
Total sales	17,022,998	39,345,831	2.31
Reconciliation with accounting records		180.601	
Other electric revenues		653,714	
Total operating revenues		40,180,146	

[1] Sales statistics include billing adjustments or revisions made subsequent to close of accounting records.

NOTE.—Major features of rate schedules:
C-3, C-4: Kilowatt-year rate for transmission firm system power.
F-2, F-3, F-4: Demand energy rate for firm power.
A-4: Kilowatt-year rate for at site firm power.
E-3, E-4: Demand energy rate for firm power for resale to ultimate consumer.
Experimental: Energy rate of 2.5 mills for developmental purposes.
H-2, H-3: Energy rate for dump, emergency, or breakdown service.
Exchange: Gross exchange account deliveries at dump energy rate.
Interruptible: Billed under C-4 and F-4 schedules with special measured demand provisions.

Low Rates Stimulate Power Use

All long-term wholesale contracts with distributors of Bonneville power contain provisions regarding resale rates and principles of operation to insure distribution for the benefit of the general public, and particularly domestic and rural consumers. The direct relationship of increased use of electric energy to the influence of lower rates is well illustrated in table XI. This shows the trends from 1938 to date on the average use and price for residential, home, and farm service in the Pacific Northwest as compared with the national average.

Added Generating Capacity

Energization of the final unit in the right powerhouse at Grand Coulee during the year, completed the 18 generator installation and increased the combined Bonneville-Grand Coulee nameplate rating to 2,462,400 kilowatts, with a maximum peak generating capability of 2,724,000 killowatts.

Federal projects existing, under construction, authorized, or recommended by the Corps of Engineers, Bureau of Reclamation, and the

Bonneville Power Administration are shown in table XII. Complete development of these multipurpose projects will provide a total of 27.3 million acre-feet of storage space for flood control and over 12 million kilowatts of peaking capability needed to meet the region's power requirements.

Non-Federal Additions

A few additions were made to non-Federal utility generating facilities during the year. The Idaho Power Co. completed its C. J. Strike plant with an installed capacity of 81,000 kilowatts, California Oregon Power Co. completed the Fish Creek plant, and Portland General Electric Co. added a 5,000 kilowatt unit at station M. In addition to these hydro installations, the Montana Power Co. completed the F. W. Bird steam plant with a nameplate rating of 60,000 kilowatts. Additions presently planned by the non-Federal utilities during the next 3 years are shown in table XIII.

TABLE XI.—Residential and rural service—average use per customer and average price per kilowatt-hour

Calendar year	Kilowatt-hours per customer		Price per kilowatt-hour	
	United States total	Oregon and Washington	United States total	Oregon and Washington
			Cents	*Cents*
1938	902	1,410	4.02	[1] 2.65
1939	953	1,467	3.87	[1] 2.55
1940	1,006	1,589	3.74	2.27
1941	1,044	1,776	3.65	2.08
1942	1,088	2,024	3.57	1.94
1943	1,135	2,279	3.50	1.84
1944	1,225	2,504	3.41	1.74
1945	1,305	2,801	3.32	1.69
1946	1,418	3,219	3.13	1.58
1947	1,546	3,696	3.00	1.49
1948	1,674	4,160	2.92	1.41
1949	1,806	4,503	2.87	1.38
1950	1,951	4,867	2.81	1.36
1951	2,137	5,205	2.74	1.34

[1] Partially estimated from State commission data.

Source: Edison Electric Institute.

TABLE XII.—General specifications—Existing, authorized and recommended projects—Installations and capabilities correspond to a coordinated system of operation of all plants shown

	Location	Stream	Plant installations [1]		Nominal prime power average [2]	Pool elevation	Usable storage	Average head	Initial date in service	Principal purposes [3]
			Number units	Total capacity						
				Kilowatts	*Kilowatts*	*Feet*	*Acre-feet*	*Feet*		
Existing projects:										
Columbia Basin project (Grand Coulee)	Washington	Columbia	18	1,944,000	[4] 1,575,000	1,288.0	5,212,000	330	March 1941	P, I, N, FC.
Bonneville	Washington-Oregon	do	10	518,400	479,000	72.0		60	January 1938	P, N.
Minidoka	Idaho	Snake	7	13,400	6,000	4,245.0	95,200	49	1909	P, I.
Boise diversion	do	Boise	3	1,500	2,000	2,800.0		31	1912	P, I.
Black Canyon	do	Payette	2	8,000	9,000	2,497.0	14,800	94	1925	P, I.
Anderson Ranch	do	South Fork Boise	2	27,000	21,000	4,196.0	464,200	260	December 1950	P, I, FC.
Projects under construction:										
Hungry Horse	Montana	South Fork Flathead	4	285,000	187,000	3,559.0	2,980,000	380	October 1952 [5]	P, I, N, FC.
Albeni Falls	Idaho	Pend Oreille	3	42,600	23,000	2,062.5	1,140,000	24	August 1954 [6]	P, N, FC.
Chief Joseph	Washington	Columbia	18	1,152,000	801,000	937.5		171	December 1955	P, I, N.
McNary	Washington-Oregon	do	14	980,000	621,000	340.0		87	December 1953	P, I, N.
The Dalles	do	do	14	1,092,000	691,000	160.0		88	November 1957	P, I, N.
Lookout Point	Oregon	Middle Fork Willamette.	3	114,000	36,000	929.0	368,000	228	July 1954	P, I, N, FC.
Dexter	do	do	1	15,000	12,000	695.0		53	December 1954	P, I, N, FC.
Detroit	do	North Santiam	2	100,000	30,000	1,569.0	340,000	299	June 1953	P, I, N, FC.
Big Cliff	do	do	1	18,000	10,000	1,206.0		81	December 1953	P, I, N, FC.
Chandler	Washington	Yakima	2	12,000	12,000			118	December 1955	P, I.
Palisades	Idaho	Snake	4	114,000	41,000	5,620.0	1,200,000	144	October 1956	P, I, FC.
Authorized projects:										
Libby	Montana	Kootenai	5	515,000	275,000	2,459.0	4,600,000	310	September 1958 [7]	P, N, FC.
Priest Rapids	Washington	Columbia	18	954,000	723,000	550.0	[8] 2,100,000	129	December 1962	P, N, FC.
John Day	Washington-Oregon	do	13	1,105,000	720,000	255.0	8,000,000	95	December 1964	P, I, N, FC.
Ice Harbor	Washington	Snake	4	260,000	204,000	440.0		93	December 1956	P, I, N.
Lower Monumental	do	do	4	240,000	194,000	533.0		89	December 1958	P, I, N.
Little Goose	do	do	4	260,000	209,000	633.0		96	December 1959	P, N.
Lower Granite	do	do	4	220,000	170,000	715.0		77	December 1960	P, N.
Hills Creek	Oregon	Middle Fork Willamette.	1	20,000	14,000	1,510.0	221,000	204	December 1957	P, I, N, FC.
Cougar [9]	do	South Fork McKenzie	1	25,000	15,000	1,683.0	182,000	418		P, I, N, FC.
Green Peter [9]	do	Middle Santiam	2	81,000	22,000	984.0	322,000	315		P, I, N, FC.
White Bridge [9]	do	do	1	15,000	9,000	670.0		93		P, I, N, FC.
Roza	Washington	Yakima	2	10,000	4,000			140	July 1955	P, I.
American Falls	Idaho	Snake	3	30,000		4,355.0	1,700,000	80	November 1955	P, I.

Recommended projects:										
Hells Canyon	Oregon-Idaho	Snake	8	800,000	688,000	2,077.0	3,880,000	510	September 1957	P, N, FC.
Upper Scriver	Idaho	North Fork Payette	3	37,500	26,000	4,505.0		400	September 1956	P, I, FC.
Lower Scriver	do	do	2	60,000	52,000	4,060.0		794	do	P, I, FC.
Garden Valley	do	South Fork Payette	4	60,000	52,000	3,266.0	843,000	334		P, I, FC.

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[1] Name-plate rating.

[2] Average capability during storage draw-down period.

[3] P—power; I—irrigation; N—navigation; FC—flood control.

[4] Pumping requirements for 450,000 acres of the Columbia Basin project have been deducted.

[5] The storage schedule at Hungry Horse is 580,000 acre-feet by September 1952, 2,000,000 acre-feet by September 1953, and 2,980,000 acre-feet of usable storage by September 1954.

[6] Total storage is scheduled for August 1952.

[7] Usable storage of 4,250,000 acre-feet is scheduled for September 1958 and total usable storage of 4,600,000 acre-feet by September 1959.

[8] Flood control storage only.

[9] Power facilities are not authorized. White Bridge is not authorized but is required for reregulating purposes with installation of generating units at Green Peter.

Source: BPA—Branch of Power Resources, Sept. 17, 1952.

TABLE XIII.—Non-Federal utilities—Generator installation schedule, March 5, 1952

Utility and plant	Unit No.	Nameplate Rating-Mw	Date in service
City of Seattle: Ross	1	90.0	December 1952.
	2	90.0	March 1953.
	3	90.0	September 1953.
		270.0	
City of Tacoma:			
Mayfield	1	40.0	August 1954.
	2	40.0	October 1954.
	3	40.0	December 1954.
	4	40.0	February 1955.
		160.0	
Mossyrock	1	75.0	October 1954.
	2	75.0	December 1954.
	3	75.0	February 1955.
	4	75.0	April 1955.
		300.0	
Chelan County PUD: Rock Island additions (owned by P. S. P. & L. Co.)	5	25.0	September 1952.
	6	25.0	November 1952.
	7	25.0	December 1952.
	8	25.0	February 1953.
	9	25.0	March 1953.
	10	25.0	May 1953.
		150.0	
Pend Oreille PUD: Box Canyon		60.0	June 1954.
Washington Water Power Co.: Cabinet Gorge	1	50.0	September 1952.
	2	50.0	October 1952.
	3	50.0	November 1952.
	4	50.0	April 1953.
		200.0	
Portland General Electric Co.:			
Station B	1, 2, 3	3.6	August 1952.
	4, 5, 6	3.6	September 1952.
	7, 8, 9	3.6	October 1952.
	10, 11, 12	3.6	November 1952.
		14.4	
Pelton	1 and 2	80.0	November 1953.
	3	40.0	January 1954.
		120.0	
Pacific Power & Light Co.: Yale	1	50.0	December 1952.
	2	50.0	January 1953.
		100.0	
California Oregon Power Co.:			
Clearwater No. 1		15.0	June 1953.
Clearwater No. 2		26.0	Do.
Lemolo No. 1		25.0	September 1954.
Lemolo No. 2		35.0	Do.
		101.0	
Idaho Power Co.:			
C. J. Strike	1	27.6	January 1952.
	2	27.6	February 1952.
	3	27.6	April 1952.
		82.8	
Dike	1	15.0	June 1954.
	2	15.0	July 1954.
	3	15.0	August 1954.
	4	15.0	September 1954.
		60.0	
Montana Power Co.: Kerr	3	56.0	October 1954.

Northwest Power Pool

Generation during fiscal year 1952 by the principal electric utility systems of the Pacific Northwest region is shown in table XIV. All of the utilities are members of the Northwest power pool. Utah Power & Light Co. and British Columbia Electric Co. are also members of the pool but are not included since their major service areas are outside the Pacific Northwest region.

The Administration supplied 61.2 percent of the total energy generated by the major utilities serving the region, as shown in chart 3. In addition to the power requirements of industries and nonpool member utilities served by the Administration, a maximum hourly delivery of nearly 900,000 kilowatts and approximately 5,100,000,000 kilowatt-hours of energy was provided for use by other pool member utilites to meet their requirements, chart 4.

Transmission System Additions

Addition of 584 circuit-miles of transmission line and 9 substations during the fiscal year gives the Administration a total of 4,954 circuit-miles of transmission lines and 132 substations, chart 5. This includes 2,409 circuit-miles of 230,000-volt line, 2,260 circuit-miles of 115,000-volt line, and 285 miles of lower voltage line, chart 6.

TABLE XIV.—Generation by the principal electric utility systems of the Pacific Northwest, fiscal year 1952

Utilities	Kilowatt-hours	Percent of total generation
Publicly owned:	*Billion*	*Percent*
Bonneville Power Administration	18.6	61.2
Seattle City Light	1.4	4.6
Tacoma City Light	.8	2.6
Total publicly owned	20.8	68.4
Privately owned:		
Puget Sound Power & Light Co	1.5	5.0
Washington Water Power Co	1.4	4.6
Pacific Power & Light Co	.8	2.6
Portland General Electric Co	.7	2.3
Montana Power Co	3.1	10.2
Idaho Power Co	2.1	6.9
Total privately owned	9.6	31.6
Total generation [1]	30.4	100.0

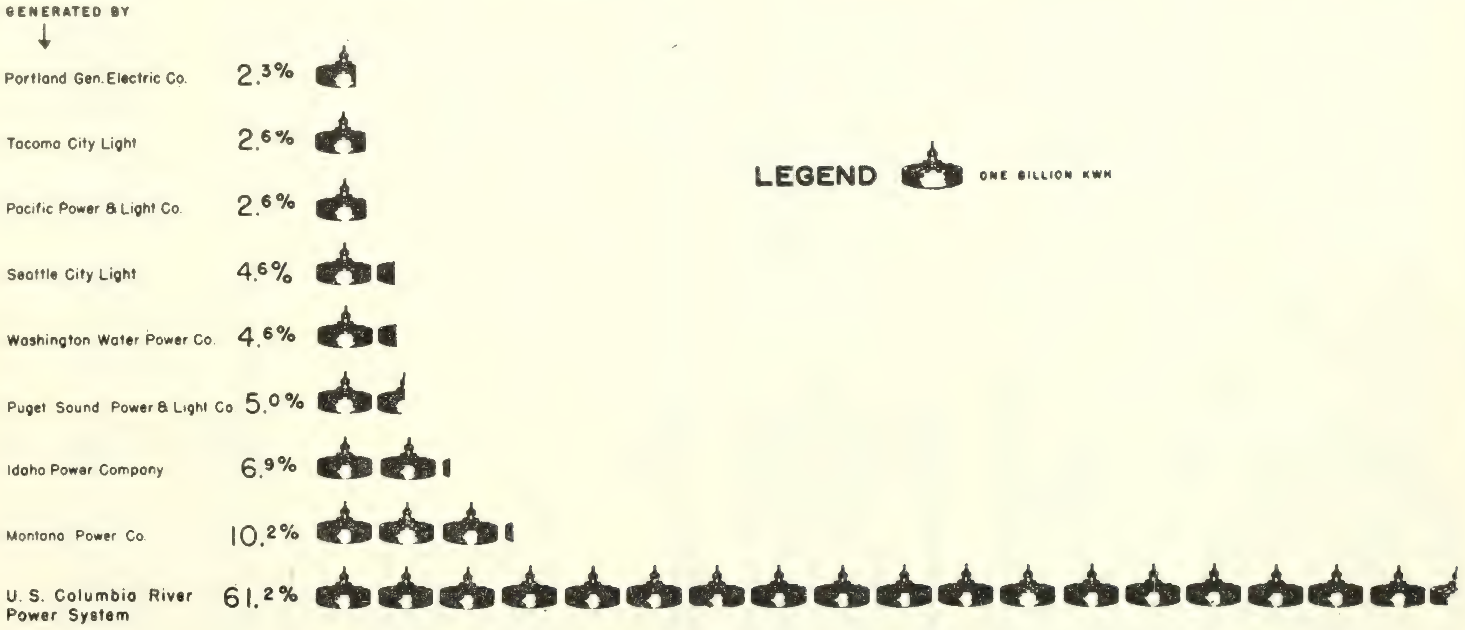
[1] The above utilities are members of the Northwest power pool. Utah Power & Light Co. and British Columbia Electric Co. are also members of the pool, but are not included above because their major service areas lie outside the Pacific Northwest region.

Source: BPA—Branch of Power Resources, Aug. 15, 1952.

Substation capacity was increased by 646,359 kilovolt-amperes, bringing the total transformer capacity to 3,553,850 kilovolt-amperes under self-cooled conditions, and a maximum of 4,516,684 kilovolt-

Power Generated BY THE PRINCIPAL ELECTRIC UTILITIES OF THE PACIFIC NORTHWEST

YEAR ENDED JUNE 30, 1952



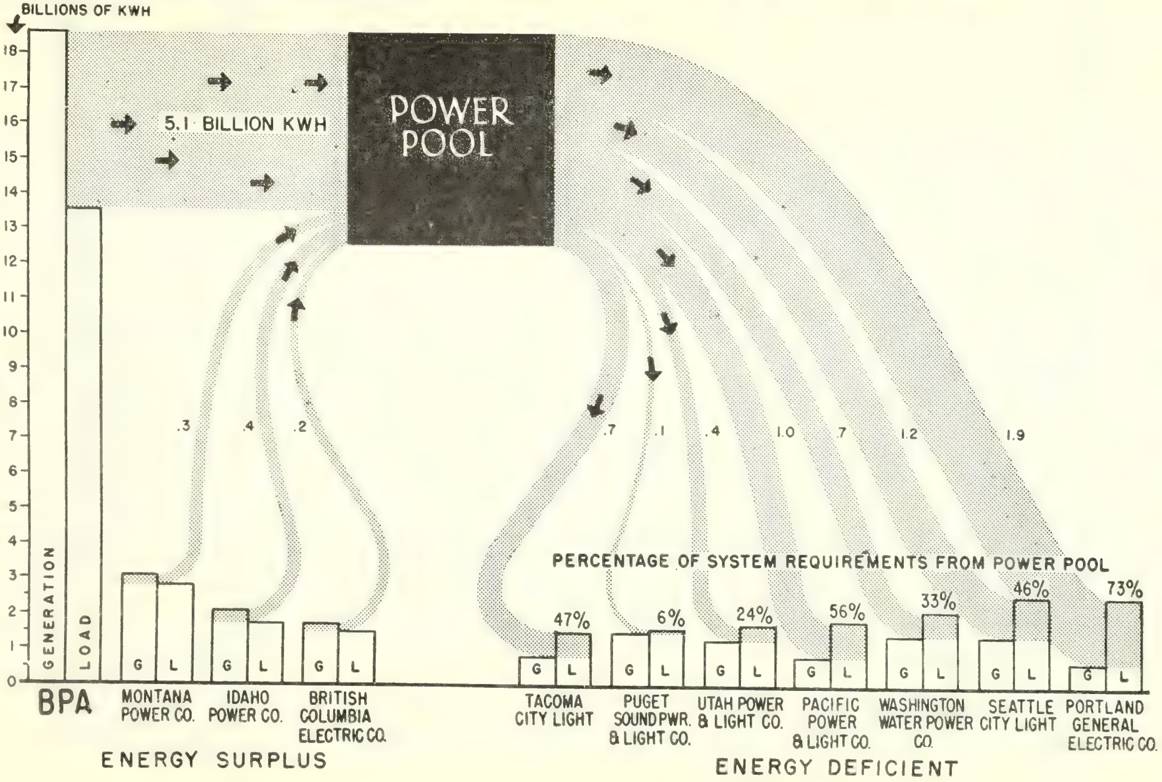
TOTAL 30.4 BILLION KWH

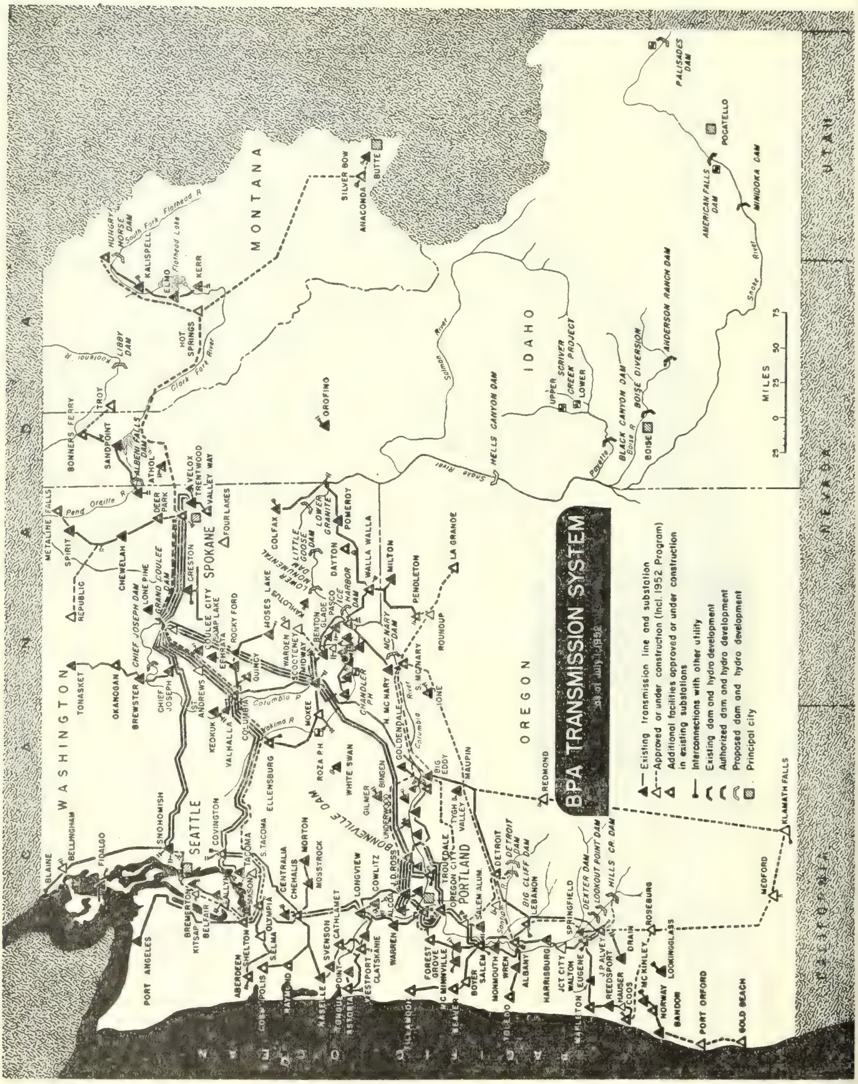
SOURCE: WEEKLY OPERATING REPORTS OF N. W. POWER POOL

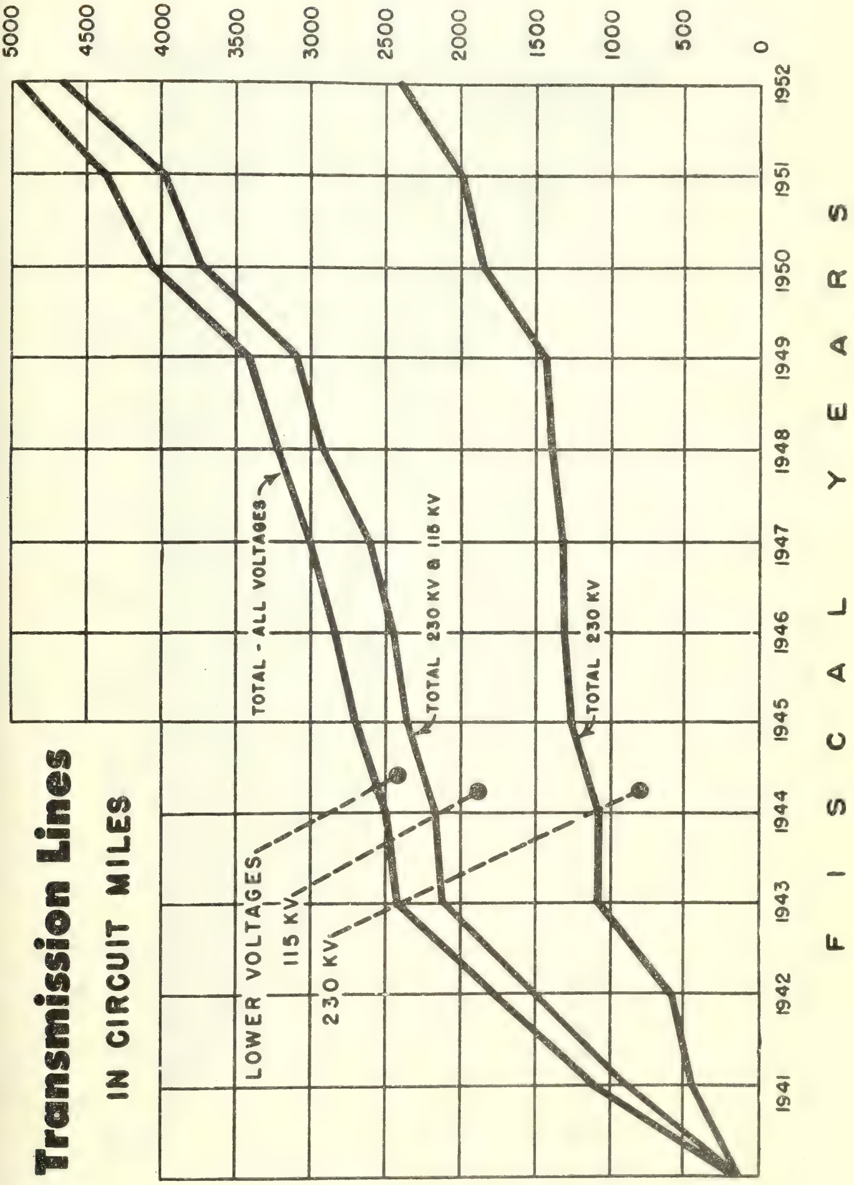
THE ABOVE UTILITIES ARE MEMBERS OF THE NORTHWEST POWER POOL. UTAH POWER & LIGHT CO. AND BRITISH COLUMBIA ELECTRIC CO. ARE ALSO POOL MEMBERS BUT ARE NOT INCLUDED IN THIS CHART BECAUSE THEIR MAJOR SERVICE AREAS LIE OUTSIDE THE PACIFIC NORTHWEST

Northwest Power Pool NET OPERATIONS YEAR ENDING JUNE 30,1952

BPA SUPPLIED 85% OF NET ENERGY REQUIREMENTS OF THE POWER POOL UTILITIES

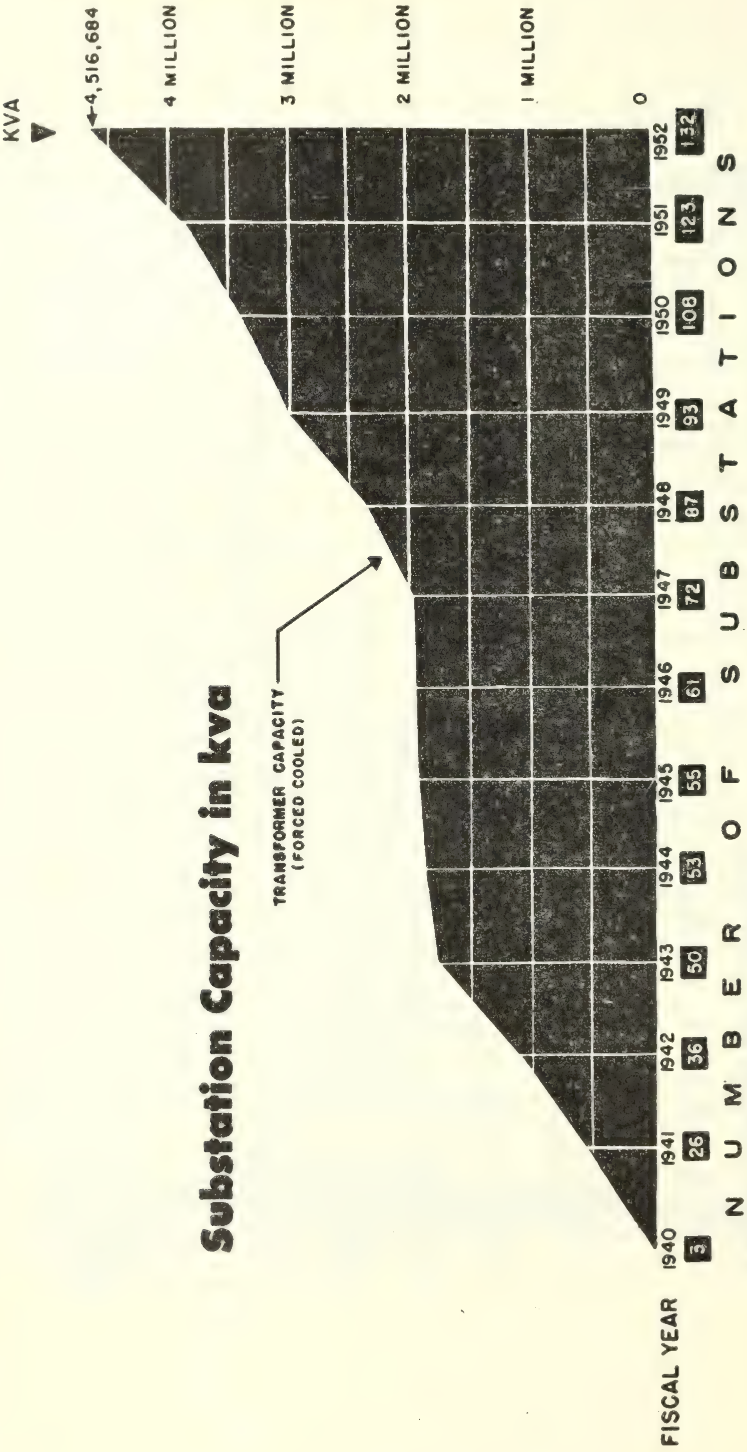



BPA TRANSMISSION SYSTEM
as of July 1, 1952
Existing transmission line and substation
Approved or under construction (Incl. 1952 Program)
Additional facilities approved or under construction in existing substations
Interconnections with other utility
Existing dam and hydro development
Authorized dam and hydro development
Proposed dam and hydro development
Principal city
MILES
25
0
25
50
75
C A N A D A
WASHINGTON
OREGON
IDAHO
MONTANA
CALIFORNIA
NEVADA
UTAH
SEATTLE
PORTLAND
SPOKANE
GRAND COULEE DAM
CHIEF JOSEPH DAM
BONNEVILLE DAM
MC NARY DAM
HELLS CANYON DAM
HUNGRY HORSE DAM
LIBBY DAM
ALBENI FALLS DAM
DETROIT DAM
LOOKOUT POINT DAM
DEXTER DAM
HILLS CR. DAM
BIG CLIFF DAM
ICE HARBOR DAM
LOWER MONUMENTAL DAM
LITTLE GOOSE DAM
LOWER GRANITE
BLACK CANYON DAM
BOISE DIVERSION
ANDERSON RANCH DAM
AMERICAN FALLS DAM
MINIDOKA DAM
PALISADES DAM
BOISE
POCATELLO
BUTTE
ANACONDA
SILVER BOW
KALISPELL
KERR
HOT SPRINGS
OROFINO
Columbia R.
Snake River
Salmon River
Clark Fork River
Flathead Lake
Pend Oreille R.
Yakima R.
Boise R.
Payette
Kootenai R.
MEDFORD
KLAMATH FALLS
REDMOND
EUGENE
SALEM
ALBANY
LONGVIEW
TACOMA
OLYMPIA
PORT ANGELES
BELLINGHAM
WALLA WALLA
PENDLETON
LA GRANDE
PASCO



Transmission Lines

IN CIRCUIT MILES



Substation Capacity in kva

amperes with forced cooling, chart 7. Additional static capacitors, with a capacity of 116,150 reactive kilovolt-amperes, were installed, bringing the total on the system to 742,550 reactive kilovolt-amperes. A new 50,000 kilovolt-ampere synchronous condenser was energized, bringing the total system capacity of this type of equipment to 407,500 kilovolt-amperes.

The major addition to the Administration's high voltage transmission grid was the completion of the 230-kilovolt line between Midway and Detroit, tying in the previously constructed facilities between Grand Coulee Dam and Midway and Detroit Dam and J. P. Alvey substation, providing a direct 230-kilovolt transmission circuit between Grand Coulee Dam and the west central Oregon area. Because of delays in delivery of the transformers at Detroit and Alvey, this circuit was placed in service initially at 115 kilovolts with plans for energization at 230,000 volts early in fiscal year 1953.

Increased transmission capacity required to carry power away from Grand Coulee Dam was provided by the energization of the Grand Coulee-Columbia line No. 4 and the Grand Coulee-Midway line No. 3. Additional service to the Puget Sound area was made possible upon completion of the Snohomish-Arlington and Snohomish-Bothell 230-kilovolt lines. A second line constructed between Olympia and Shelton increased the capacity available to the Olympic Peninsula.

Major substation additions during fiscal year 1952 include an additional 250,000 kilovolt-ampere transformer at the Glenn H. Bell substation, Spokane, a 250,000 kilovolt-ampere transformer replacing a 66,666 kilovolt-ampere transformer at the Columbia substation, and a new 100,000 kilovolt-ampere transformer at the Oregon City substation.

New Construction in Progress

Major construction activity under way during fiscal year 1952, and scheduled for completion in fiscal year 1953, was concentrated in the western Montana area, with construction contracts in progress on lines connecting Hungry Horse Dam and Anaconda to the main 230,000 volt grid by way of Spokane. Extension of the transmission system further down the power-short southern Oregon coastal area was pushed forward with construction contracts awarded for a 115,000-volt line between Bandon, Port Orford, and Gold Beach, scheduled for completion early in 1953 fiscal year.

Extensive right-of-way clearing operations were under way in fiscal year 1952 prior to construction of high voltage lines between McNary Dam and Troutdale, Columbia and Olympia, and a line to Klamath Falls in southern Oregon.

Special Projects and Engineering Advances

The second installation of series capacitors on the system was placed in service during fiscal year 1952 at the Rocky Ford compensation station on the Grand Coulee-Midway 230,000-volt line No. 3, increasing the capacity of this line by 33 percent. Successful use of series capacitors at Rocky Ford, and at the previously energized Chehalis installation, justifies further use of this device on other transmission lines, thereby increasing the capacity of these circuits and improving their operating characteristics. An additional installation will be placed in service early in fiscal year 1953 and studies are in progress to determine the most beneficial locations for future applications of this equipment.

Contracts were awarded for two 400,000-kilovolt-ampere 230,000–300,000 volt autotransformers scheduled to be installed in December 1954 on the Grand Coulee-Olympia transmission line. These transformers are the first pieces of such high voltage level equipment placed on order since the decision of the Administration to study and adopt transmission voltages higher than 230,000 volts. Studies continued throughout the year and plans are being made for future circuits to be operated at 300,000 and 345,000 volts.

Use of higher voltage transmission is expected to result in considerable economic savings because of the increased loadings possible on a single circuit, with the resultant savings in the number of transmission circuits required, especially in lines which traverse the difficult and costly construction terrain of the Cascade passes. The engineering staff believes use of higher transmission voltages will provide the basic solution to some of the problems inherent in the nation's largest transmission system.

RECOMMENDATIONS

Inasmuch as operations from the inception of the Federal power program in the Pacific Northwest to June 30, 1952, have produced net revenues of $83,600,000 after providing for all expenses for operation, maintenance, administration, marketing, etc., interest and depreciation, the Administration has not found it necessary to increase the basic wholesale rate level since its adoption in 1938 despite the very general and substantial increase in all types of cost during the war years and the post war period. Beginning with fiscal year 1953 and continuing for many years, new dams, constructed at higher cost levels than those of the existing dams, will be placed in operation. The Administration anticipates that as the result of the addition of these higher cost power supplies to the system, together with higher costs generally for goods and services, some increases in the wholesale power rate level may be required at the next rate adjustment date, December 1954. The Administration recommends that financial policies, which have been substantially unchanged from the rather arbitrary principles adopted originally for the existing projects, underlying the fixing of rate levels be reviewed critically prior to a determination of the changes, if any, that may be required in rates in 1954. The following specific recommendations are submitted for immediate consideration:

1. The Administration recommends that all costs incurred by the Government as a whole for the benefit of the Federal power program in the Pacific Northwest, regardless of whether such costs are met from the appropriations of the power agencies or from the appropriations of other Federal agencies, be reflected in the power cost accounts to the extent such costs are material and are susceptible of reasonably accurate determination by direct analysis. Costs incurred from appropriations other than those made directly to the power agencies included interest, claims paid by the Bureau of Employees' Compensation, the civil service retirement system costs, and goods, rents and other services supplied by the General Services Administration or other Federal agencies. The power accounts have always reflected some of these costs, principally interest, but not all of them.

2. The Administration recommends that the 50-year period heretofore comprising the general standard for the repayment of the power investment be modified to conform more closely to generally accepted electric utility practice with respect to the recovery of capital costs. The present 50-year limitation is extremely conservative—much more so, in fact, than the standard followed in the private electric utility business—and presumably reflects the opinion that the possibility of economic obsolescence precludes looking ahead more than 50 years at any time. However, the application of the 50-year limitation on an individual project rather than on a system basis produces an illogical result inasmuch as it leads to the conclusion that the earlier dams terminate their economically useful life much sooner than the later dams that may be completed several years after the earlier ones. Any obsolescence factor, except for special conditions such as the silting of reservoirs, applies to the entire electric operation rather than to individual projects in the system. Accordingly, as a minimum modification of the repayment period, the maximum economic life should be established and reviewed from time to time for the entire power system operation and upon each revision of the estimate the total unpaid investment at that time should be scheduled for repayment over the remaining years in the assumed life period for the system. Under this plan it would still be possible, nevertheless, to provide that the repayment period would never be extended, as of

any given time, more than 50 years in the future or beyond the economically useful life of the system or any project.

3. The Administration recommends that all revenues and costs of the power system, including nonpower costs to be returned from power revenues, be pooled on a system basis and that the present authority for such pooling be clarified by appropriate Executive or departmental order or by legislation if necessary. Such a policy is in accordance with the basic marketing and operating principles of the controlling statutes which require the sale of the power at the lowest possible rates consistent with sound business principles and the sale of power so as to encourage the most widespread use.

4. The Administration recommends the development and adoption by Executive or departmental order, or by legislation if necessary, of basic principles to govern the allocation of the joint costs of multiple purpose projects. Such allocations are an important prerequisite to the determination of power rate levels, but at best they are based on arbitrary procedures inasmuch as joint costs are, by definition, those that cannot be assigned directly to a single function. Accordingly, the simplest and most direct techniques or joint cost allocation should be the most acceptable.

5. The Administration recommends that legislation be sought to place the financing of the capital and operating costs of the power program on a businesslike basis. As of June 30, 1952, the capital investment in multipurpose dams and reservoirs, power plants, irrigation works, and the transmission system in the Pacific Northwest approached $1 billion (including completed projects and those under construction), of which the major portion is directly chargeable to commercial power operations or is to be returned to the Treasury from commercial power revenues. Estimates for the next several years indicate that an additional investment of approximately $350 million per year will be required in dams, reservoirs, power plants, navigation locks, flood-control facilities, irrigation works and the transmission facilities, if proposed program schedule is to be maintained. The traditional method of financing through annual congressional appropriations may very well be inadequate to meet this fund requirement.

SOUTHWESTERN POWER ADMINISTRATION

Douglas G. Wright, Administrator

In the fiscal year 1952, Southwestern Power Administration received $4,630,712 in appropriations for carrying on its over-all program; $3,375,000 was earmarked for the construction program, of which $600,000 was appropriated for the liquidation of previous contract authorizations; and $1,255,712 was allotted to the operations and maintenance program. Congress also authorized the Administration to take over the jurisdiction and control of the 15-mile Denison-Payne 132-kilovolt transmission line without transfer of funds.

ENERGY PRODUCTION

Adverse water conditions prevailed over the drainage areas of two projects under jurisdiction of the Administration. Rainfall over the the drainage area of Denison project was 25 percent below normal and in the Norfork project watershed rainfall was 10 percent below normal. In the Narrows basin rainfall was 10 percent above normal. Net generation from the three reservoir projects was as follows:

	Kilowatt-hours
Denison	142, 560, 000
Narrows	42, 526, 920
Norfork	338, 925, 200

ENERGY DELIVERIES

Gross revenue from sales by the Administration during the year amounted to $2,635,193.60, and net revenue, after payment of purchase of power, interchange and service charges, totaled $2,567,311.54. By the end of the fiscal year, wholesale electric power and energy generated by the hydroelectric facilities under the marketing jurisdiction of the Administration were being sold to 18 rural electric cooperatives, 11 municipalities, 5 private utility companies, and 1 United States military installation.

Net revenue from sales to preferred customers totaled $883,571.27, and to private utility companies $1,683,740.27 for power and energy delivered through the year.

The Administration delivered wholesale service to preferred customers directly over its own lines and also through the facilities of the Texas Power & Light Co., Southwestern Gas & Electric Co., Public Service Co. of Oklahoma, and Oklahoma Gas & Electric Co.

NEW POWER CONTRACTS

Reynolds Metals Co.

Southwestern Power Administration and the Arkansas Power & Light Co. negotiated a triparty contract with the Reynolds Metals Co. under which wholesale electric service will be furnished to the latter for the production of aluminum in Arkansas. The Administration will provide 150,000 kilowatts of peaking capacity and a monthly average of 30,000,000 kilowatt-hours to Arkansas Power & Light Co. The company, in turn, will deliver an estimated 80,000,000 kilowatt-hours per month to the Reynolds plant at approximately 110,000 kilowatts capacity.

Preferred Customers

Ten existing rural electric cooperative contracts were amended to increase contract demands a total of 3,675 kilowatts.

Nine new contracts were executed to serve customers under the Oklahoma contract. These include 7 municipalities with a total contract demand of 2,675 kilowatts, the partial load of one rural electric cooperative in the amount of 400 kilowatts, and the military installation of Fort Sill, Okla., with a contract demand of 4,000 kilowatts.

Contracts were executed for power to be delivered by the Southwestern Gas & Electric Co. for the account of the Administration in serving four rural electric cooperatives with a total demand of 4,065 kilowatts.

Contracts were executed for electric service to be furnished by the Administration through the leased facilities of generating and transmission cooperatives to four municipalities with a total demand of 2,600 kilowatts.

At the end of the fiscal year 74 percent of the primary energy of the hydroelectric projects was being sold to preferred customers.

CONTRACT NEGOTIATIONS

During the fiscal year, the Southwestern Power Administration has been negotiating an electric-service agreement with 12 private utility companies operating in the Southwest. This agreement is now before the Department of the Interior for study and recommendations.

The electric-service agreement is similar to the agreement between the Government and the Public Service Co. of Oklahoma and the Oklahoma Gas & Electric Co., and covers sale, exchange, purchase, and delivery of electric power and energy. The proposed agreement provides for the integration of part of the power and energy produced at Government-owned hydroelectric projects with power and energy produced by the plants of the utility companies. Under the proposed agreement, the capacity of hydroelectric projects would be used for supplying part of the peak loads in the area, while the companies would supply thermally produced power and energy for the off-peak loads of certain of the Government's customers. The proposed agreement further provides that the transmission facilities of the companies can be utilized to serve loads of the preferred customers of the Government.

The following is a list of the 12 companies presently negotiating with the Government:

Arkansas-Missouri Power Co.
Arkansas Power & Light Co.
Central Louisiana Electric Co., Inc.
The Empire District Electric Co.
Gulf States Utilities Co.
Kansas City Power & Light Co.
Louisiana Power & Light Co.
Missouri Power & Light Co.
Missouri Public Service Co.
Missouri Utilities Co.
Southwestern Gas & Electric Co.
St. Joseph Light & Power Co.

PERSONNEL

Total employment in the Administration at the close of the fiscal year was 300 full-time employees. Two hundred and twenty-six are serving under permanent or probational appointments; 62 under indefinite appointments; and 12 under excepted appointments. One hundred and forty employees have veterans' preference including 134 men and 6 women. Forty-seven employees are under the benefits of the Social Security Act and 253 have Retirement Act benefits.

SUPPLY AND PROCUREMENT

Total expenditures for supply contracts, open-market transactions, and purchase orders for the fiscal year amounted to $351,037 (exclusive of contracts for transmission lines, substations, and equipment). Responsibility for the maintenance of property records was defined in a general order issued by the Administration covering real property and equipment. Procedure for opening bids and awarding contracts was established by general order and delegations of authority to execute contracts were given.

NEW ACCOUNTING SYSTEM

During the year, the Administration has made a complete revision of its accounting system and on-site audit procedures have been approved. The system and related procedures were worked out in conjunction with representatives of the General Accounting Office, Department of the Interior, and this Administration. The manual covering the procedures prescribed under the new accounting system has been submitted through the Department to the Comptroller General for review and approval in accordance with the Budget and Accounting Procedures Act of 1950, and has been approved by the Comptroller General.

LITIGATION

Southwestern Power Administration has been concerned with significant litigation during the fiscal year 1952 as follows:

Kansas City Power & Light Co. et al. v. *Oscar L. Chapman, Secretary of the Interior et al.* (Civil No. 4276–50, U. S. District Court, District of Columbia). This is a suit instituted by the Kansas City Power & Light Co. and nine other private utility companies in the southwestern area against the Secretaries of the Treasury, Agriculture, and Interior, the Administrators of Rural Electrification Administration and Southwestern Power Administration, for injunctive and declaratory relief primarily to enjoin the defendants from advancing, transmitting, lending, giving, or disbursing moneys to certain federated cooperatives in Missouri, Northwest Electric Power Cooperative, Central Electric Power Cooperative, and Sho-Me Power Corp., for the construction of the electric facilities or in furtherance of any of the projects described in the complaint. The cause is at issue and stands for trial October 13, 1952.

No. 12095.—After the filing of the suit mentioned above, the Kansas City Power & Light Co. and five other private utility companies listed as plaintiffs in the District of Columbia suit filed a complaint before the Public Service Commission of Missouri against the Northwest Electric Power Cooperative and Douglas G. Wright, as Administrator of Southwestern Power Administration, to require the cooperative to obtain a certificate of convenience and necessity for its generation and transmission system in the State of Missouri, and to require Douglas

G. Wright as Administrator of SPA, to comply with the rules and regulations of the Public Service Commission of Missouri with respect to the sale and transmission of electric power and energy in the State of Missouri, which is now pending on motion to dismiss filed by both the cooperative and the Administrator.

United States v. *Arkansas Power and Light Co.* (No. 1370 L. R. Civil, U. S. District Court, Eastern District of Arkansas). This is an action for damages for breach of contract arising out of the energy sales agreement between the Government and the company of date February 20, 1945, through the failure of defendant to effectuate the $150,000 annual reduction called for by the contract. The case was heard during the period January 14 through January 17, 1952, and on March 20, 1952, the court entered judgment dismissing the Government's complaint with prejudice for want of equity and reforming the contract by striking the date February 20, 1945, and substituting a date October 31, 1944, the date upon which the November 1944 rate schedules were approved. The Government filed its notice of appeal on May 1, 1952, and the appeal was docketed on July 28, 1952, in the United States Circuit Court of Appeals for the Eighth Circuit.

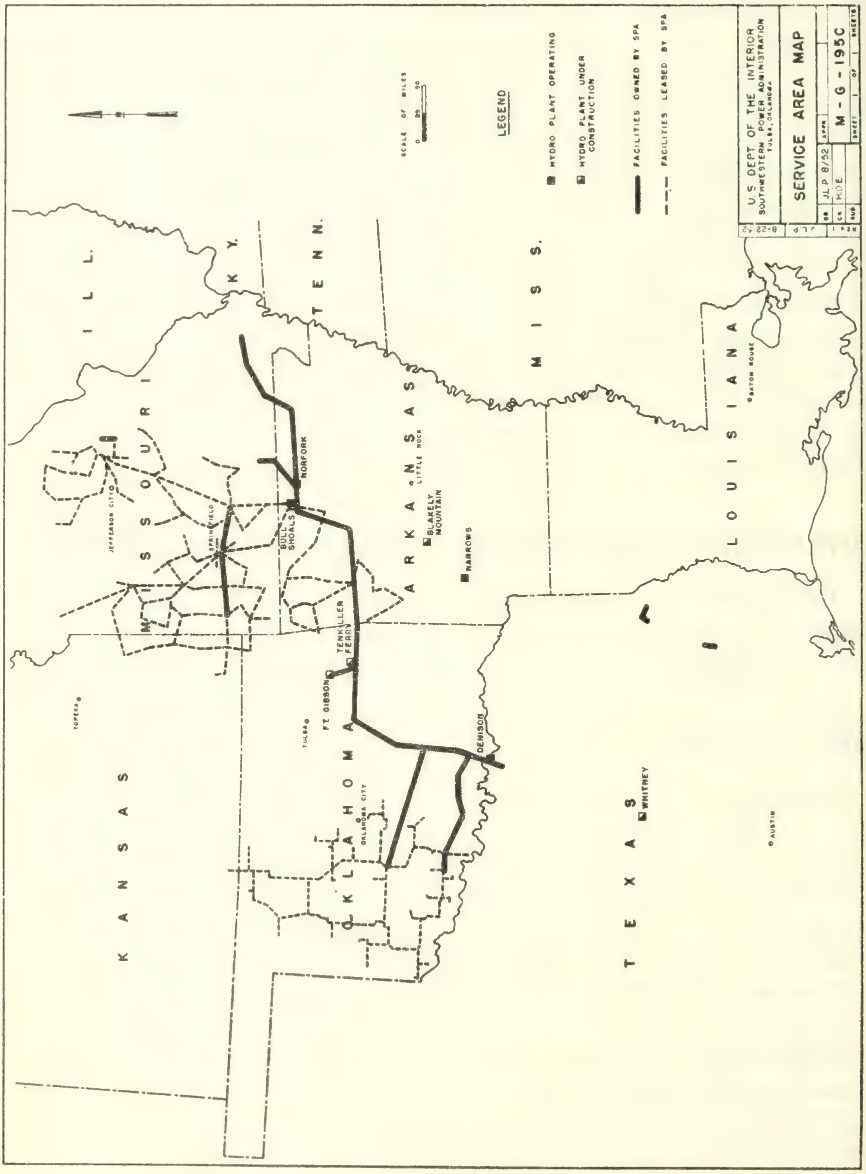
ARKANSAS-WHITE-RED BASINS INTER-AGENCY COMMITTEE

During the year, representatives of SPA participated with officials of other departments, bureaus, and agencies in plans and studies for the development of the Arkansas, White, and Red River Basins.

SPA SYSTEM

Southwestern Power Administration now maintains and operates approximately 980 miles of transmission line as shown on the system map (chart I). During the fiscal year, two substations, two switching stations, and approximately 18 miles of 66-kilovolt lines were added to the system. On June 28, 1952, the Norfork-Bull Shoals-Mansfield line and the Mansfield temporary substation were energized to supply power to Sho-Me Power Corp.

In fiscal 1953, four new projects will be added to SPA's system (Bull Shoals in Arkansas, Fort Gibson and Tenkiller Ferry in Oklahoma, and Whitney in Texas). These will provide an initial capacity of 273,200 additional kilowatts for electric service to the Administration's wholesale customers in the Southwest. Eighteen miles of 66-kilovolt line will be completed in 1953. Three switching stations, four substations, an extension to a substation, 15 unit substations, and approximately 15 miles of 66-kilovolt lines will be under contract in 1953.


U.S. DEPT. OF THE INTERIOR
SOUTHWESTERN POWER ADMINISTRATION
TULSA, OKLAHOMA
SERVICE AREA MAP
M-G-195C
DR JLP 8/52
CK H.D.E
SHEET 1 OF 1 SHEETS
8-22-52
LEGEND
HYDRO PLANT OPERATING
HYDRO PLANT UNDER CONSTRUCTION
FACILITIES OWNED BY SPA
FACILITIES LEASED BY SPA
SCALE OF MILES
0 25 50
KANSAS
MISSOURI
ILL.
KY.
TENN.
ARKANSAS
MISS.
LOUISIANA
OKLAHOMA
TEXAS
TOPEKA
JEFFERSON CITY
SPRINGFIELD
NORFORK
BULL SHOALS
LITTLE ROCK
BLAKELY MOUNTAIN
NARROWS
TENKILLER FERRY
FT. GIBSON
TULSA
OKLAHOMA CITY
DENISON
WHITNEY
AUSTIN
BATON ROUGE

SOUTHEASTERN POWER ADMINISTRATION

Charles W. Leavy, Administrator

POWER RESOURCES

Installed generating capacity almost doubled during the fiscal year 1952:

Project	Basin	Kilowatts of installed capacity	
		Beginning of year	End of year
Allatoona	Etowah (Ga.)	74,000	74,000
Dale Hollow	Cumberland (Ky.)	36,600	36,600
Center Hill	do	135,000	135,000
Wolf Creek [1]	do		180,000
Total		245,600	425,600

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[1] 90,000 kilowatts additional capacity to be installed by August 1952.

Projects under construction moved closer to initial operation:

Project	Basin	Operation of first unit	Ultimate capacity in kilowatts
Clark Hill	Savannah (Ga.)	October 1952	280,000
John H. Kerr	Roanoke (Va.)	do	204,000
Philpott	do	January 1953	14,000
Jim Woodruff	Appalachicola (Fla.)	July 1954	30,000
Cheatham	Cumberland (Tenn.)	May 1955	36,000
Buford	Appalachicola (Ga.)	December 1956	86,000
Total			650,000

Planned projects were more specifically defined as future power sources:

Project	Basin	Operation of first unit	Ultimate capacity in kilowatts
Old Hickory	Cumberland (Tenn.)	April 1955	100,000
Carthage	do	November 1956	92,000
Gathright	James (Va.)	December 1956	34,000
Celina	Cumberland (Ky.-Tenn.)	February 1957	64,800
Lower Cumberland	Cumberland (Ky.)	July 1957	130,000
Hartwell	Savannah (Ga.-S. C.)	December 1957	180,000
Howell Mill Shoals	Coosa (Ala.)	do	200,000
Upper Columbia	Appalachicola (Ala.-Ga.)	December 1958	97,500
Total			898,300

POWER SALES AND REVENUES

Power generated at the Dale Hollow, Center Hill, and Wolf Creek projects was sold to the Tennessee Valley Authority; that generated at the Allatoona project was sold to the Georgia Power Co. Revenues for the fiscal year amounted to $5,257,128, a greater amount than the total of revenues collected for all previous years combined. Total revenue collected by the Southeastern Power Administration for all years was $9,045,178.

BUDGET AND STAFF

The Congress appropriated a total of $518,500 for the agency to carry out all activities during the fiscal year. The appropriation was divided into a $318,000 allowance for transmission-line construction and a $200,000 allowance for agency operation and maintenance. Thirty-three persons were employed by the agency at the beginning of the year. There was a gradual recruitment during the year of 23 additional employees, so that the year was concluded with a total working force of 56 employees assigned to all activities.

PROGRAM ACCOMPLISHMENTS

Continuing Studies and Collection of Data

Some progress was made in conducting the extensive hydrologic, economic, and engineering study upon which the proper transmission and disposal of power depends. Work was done to determine operating characteristics of projects, opportunities for integration among projects and river basins, and quantities and kinds of power to become available under widely varying conditions. Firming energy requirements for the projects were studied, and rate-structure determinations were made as allocations of costs to power were developed. Performance definitions were established for transmission facilities required to accomplish integrated operation of projects and delivery of power to purchasers. Data specifying the nature and extent of preference agency loads was collected. Systematic continuation of these long-term tasks was frequently interrupted as the agency's small staff was required to solve the numerous problems raised in arranging for the sale of power which awaits immediate disposal.

There was during the year a resolution of cost uncertainties at the Clark Hill project which allowed the rate for Clark Hill power to be reduced to a monthly demand charge of 75 cents per kilowatt and an energy charge of 4 mills per kilowatt-hour.

Contract Negotiations

Wheeling and firming arrangements continued to be discussed with the private utility companies of the Southeast. Contract negotiations proceeded throughout the year with Virginia Electric & Power Co. and agreement was reached on a contract for the sale, wheeling, and firming of power to be generated at the John H. Kerr project. It was agreed that two-thirds of the power (114,000 kilowatts of dependable capacity and 43,000 kilowatts of nondependable capacity) will be placed on the company's system; it was agreed that the company will wheel up to 60,000 kilowatts of power for sale by the Southeastern Power Administration to preferred agencies in Virginia and North Carolina; and it was agreed that the company will sell to Southeastern fuel-generated energy to firm the output of the project during periods of low water so that continuous deliveries can be made to serve the needs of preferred agencies. When the year ended, negotiations were at an advanced stage for the sale of power to 16 of the preferred agencies for whom service is provided under the arrangement.

A written agreement in the form of a memorandum of understanding was executed with the Seminole Electric Cooperative, of Florida, which committed Southeastern to deliver 7,500 kilowatts of Jim Woodruff power when the project is interconnected with another Federal reservoir project. Contracts envisioned by previously executed memoranda of understanding with the Alabama Electric Cooperative and the South Carolina Public Service Authority were in the process of negotiation as the year ended.

Construction

To carry out contractual obligations to deliver Clark Hill power to the Greenwood County Electric Power Commission, construction was begun on 41 miles of 115 kilovolt transmission line from the project to a point of delivery in the vicinity of Greenwood, S. C. When the year ended, design work for the line was approximately 85 percent complete, land acquisition was approximately 33 percent complete, clearing of right-of-way was approximately 20 percent complete, and contracts had been awarded for a major portion of construction materials.

DIVISION OF MINERALS AND FUELS

Larry E. Imhoff - Director

Reorganization Plan No. 3 of 1950, among other things, provided for an additional Assistant Secretary of the Interior. Pursuant to approval of this Plan, Secretarial Order No. 2602, dated December 1, 1950, assigned responsibility for supervision of the Mineral Resources area of the Department to an Assistant Secretary and established within his office a Division of Minerals and Fuels. The agencies over which the Assistant Secretary for Mineral Resources exercises secretarial direction are the Bureau of Mines, Geological Survey, Defense Minerals Exploration Administration, the Division of Geography and the Oil and Gas Division.

The principal functions of the new Division of Minerals and Fuels are (1) to furnish technical staff assistance to the Assistant Secretary for Mineral Resources, (2) to assist in the development, coordination and management of programs for this area, (3) to review, evaluate and make recommendations on the development and utilization of minerals and fuels, and (4) to assist the Assistant Secretary in supervising and coordinating the execution of these programs by the Bureaus and other agencies. The Division also maintains liaison with other staff units within the Secretariat and with other agencies of Government on matters pertaining to minerals and fuels.

The President's Materials Policy Commission

On January 22, 1951, the President constituted the Materials Policy Commission for the purpose of studying the materials problem of the United States and its relation to the nations of the free world; the report of the Commission, "Resources for Freedom," was published during June 1952. The Division of Minerals and Fuels participated upon a continuing basis with Commission staff in undertaking this exhaustive study. Members of the Division staff were assigned to the Commission on both a full and part time basis to assist in certain phases of the Commission's work. This included consultation on technical as well as policy matters. The Division also carried the responsibility of coordinating all the Department's efforts, correlative to the Commission's work, within the minerals agencies supervised by the Assistant Secretary for Mineral Resources.

Defense Minerals

On October 19, 1951, following the establishment of the Defense Materials Procurement Agency, the Assistant Secretary for Mineral Resources was assigned the responsibility of supervising those defense exploration functions remaining within the Department of the Interior. Subsequently, the Division of Minerals and Fuels, working with the Bureau of Mines, the Geological Survey, and other officials within the Department, formulated and implemented a plan of organization to carry out exploration functions. The Division has continued to review exploration policies and programs and render advice to the Assistant Secretary.

Stockpiling

The Assistant Secretary serves as the Department's representative on the Interdepartmental Stockpiling Committee of the Munitions Board and as the delegate of the Secretary in discharging the Secretary's joint responsibilities, with the Munitions Board, of determining the composition of the stockpile. The Division of Minerals and Fuels provides the alternate to the Assistant Secretary in this capacity, the alternate member having primary responsibility for marshalling and coordinating staff assistance within the several minerals agencies. The Division of Minerals and Fuels and the Munitions Board staff recently undertook a comprehensive review of stockpiling policy in cooperation with the other agencies represented on the Stockpile Committee.

Basic Data

The present knowledge of the country's mineral resources represents only a small part of that required for a comprehensive and reliable appraisal of our mineral wealth. Therefore, a continuing need is one of expanding and directing wisely topographic and geologic mapping activities. The Division of Minerals and Fuels has been working closely with the Budget Bureau, the Geological Survey and other concerned agencies in developing an improved procedure whereby requirements for such data can be adequately expressed and the subsequent work programmed upon a realistic priority basis.

Economic Studies

The Division of Minerals and Fuels has assumed the leadership in reviewing certain mineral resource problems, both domestic and foreign. Much of this work is done in collaboration with other federal agencies and is of a highly classified nature.

Minerals Taxation

The Division of Minerals and Fuels in collaboration with the Bureau of Mines has undertaken an analysis of all tax measures affecting the minerals industries. The purpose of this work is to establish a factual basis for policy evaluation of present and proposed tax measures in terms of their effect upon the various segments of the minerals industry.

BUREAU OF MINES

John J. Forbes, Director

Contributing fully to the national defense program and at the same time strengthening and expanding the foundation of mineral wealth that supports our economy, the Bureau of Mines carried on its many-sided activities with vigor during fiscal year 1952. With the Korean conflict as yet unresolved and after more than a year of defense effort, it was apparent that the emergency and its ever-increasing demands for minerals and mineral fuels might extend indefinitely.

Even without an emergency, our consumption of many minerals would exceed the domestic supply. New uses for minerals are being discovered; our population is growing steadily; and we are becoming increasingly dependent on foreign sources. With these facts clearly in mind, the Bureau persevered in research and development work to furnish new supplies of minerals and planned for future military and economic needs.

True mineral conservation can be achieved only by efficient extraction and utilization. Therefore, Bureau engineers and metallurgists devoted their energies to testing and improving mining equipment, investigating and evaluating mineral deposits, and developing new methods of ore concentration and beneficiation. Mineral-fuel reserves were appraised. Production methods were improved by informing industry of technologic advances. Statistical and economic data were collected on all phases of mineral production, supply, and consumption.

A diversified health and safety program remained a major Bureau activity and continued to prove effective in lowering costs and increasing production in the minerals and allied industries. The Bureau continued to advise and assist other Federal and State agencies and industry, and to aid many foreign countries under the various technical cooperation programs.

Vital problems received first consideration. Top priority was given efforts to increase the domestic supply of manganese, urgently needed by an expanding steel industry. From a low-grade ore deposit, the Bureau produced material acceptable for making ferromanganese. Production of spiegeleisen marked completion of the first step in moderate-scale experiments to develop an economic process for reclaiming manganese from open-hearth slag. Other experiments promised means of utilizing the vast manganiferous deposits of the Cuyuna range.

Other ferrous metals problems were studied. Research progressed on recovery of cobalt, nickel, and tungsten, and the St. Lawrence seaway, proposed for obtaining iron ore from Canada, was studied further.

Bureau mining engineers spent much time evaluating prospects for which Defense Minerals Exploration Administration assistance was sought and making monthly examinations of active projects. DMEA work occupied virtually the full time of those in one region. Commodity specialists in Washington also cooperated fully with DMEA and the Defense Materials Procurement Agency.

The Bureau participated in Interior's long-range river-basin program, investigating and reporting on mineral resources in several project areas. Resources of 12 States in the Arkansas-White-Red River Basins and the Missouri River Basin were investigated, and reports were made on 25 commodities in the New England-New York area. Studies are beginning in four other areas.

Zinc and tin came in for concentrated study. A process for extracting zinc from oxidized ores reached the pilot-plant stage, and substantial amounts of tin were recovered from waste products for the Atomic Energy Commission.

Bureau investigations of uranium and thorium deposits also disclosed promising sources of columbium and tantalum, and have already resulted in actual production operations. Research was aimed at improving recovery processes and developing new uses for such rare metals as hafnium, germanium, gallium, and indium.

The Bureau reached the final step in a long-range study to produce aluminum from domestic aluminum silicate deposits and thereby minimize dependence on foreign bauxite. Studies were continued on beneficiation of domestic low-grade bauxite, and research progressed on the metallurgy of lightweight magnesium-lithium aluminum alloys.

Although its process for making metallic titanium is now commercial, the Bureau is constantly working to improve production techniques and equipment design. Special high-purity titanium sponge was produced for use at the Watertown Arsenal, and prototypes of weapons were made from titanium for Army Ordnance field tests.

By its own process the Bureau supplies the Atomic Energy Commission with zirconium, a remarkable new metal not yet produced commercially in volume. This metal is highly resistant to corrosion and can withstand high temperatures. During the year, the Bureau increased production of ductile zirconium sponge for AEC and completed a new purification plant. A purification-reduction step was developed, which will increase the plant's capacity by at least 50 percent with little additional equipment.

Sulfur, fluorine, mica, and talc received special Bureau attention. Several possible sulfur sources were investigated, and tests were made to develop economical methods of separating fluorine from phosphate rock. Synthetic mica flake was made into sheets which promise to replace strategic mica for many uses, and substitutes were developed for block steatite talc.

The Bureau's inventory of coking-coal reserves was continued vigorously. Known minable reserves were determined for 4 counties, and investigations are proceeding in 12 other counties in 5 States. Reports on cleaning coals to meet metallurgical standards were completed for four counties in Pennsylvania and three in Kentucky.

The Anthracite Research Laboratory at Schuylkill Haven, Pa., was enlarged by completion of a new wing. Bureau activities in the anthracite region ranged from experiments with new mining methods to gasification tests on breaker refuse. Methods of increasing recovery in steeply pitching anthracite beds were demonstrated, and a study of launder screens for cleaning anthracite fines gave design data for a pilot test unit.

Through intensive research and development, the Bureau continued to prepare for a synthetic liquid fuels industry based on coal or oil shale. At the new gas-synthesis coal-to-oil demonstration plant at Louisiana, Mo., three successful runs were completed during the year, producing mostly gasoline and Diesel fuel and proving the technical feasibility of the Bureau's modified Fischer-Tropsch process. Coal-hydrogenation operations at Louisiana produced over a million gallons of middle oil and about 600,000 gallons of gasoline which was tested satisfactorily in military equipment. Laboratory and pilot-plant tests at Bruceton, Pa., and Morgantown, W. Va., furnished valuable information on coal-to-oil processes. Late in the year, ground was broken for a new $2.6 million experiment station at Morgantown.

At Rifle, Colo., a Bureau process that eliminates the need for cooling water in retorting oil shale was ready for demonstration-scale tests, and construction was begun on a 300-ton-a-day plant. The oil-shale refinery at Rifle continued to produce satisfactory Diesel fuel. New facilities made production of shale-oil gasoline possible. Modified drilling methods at the Experimental Oil-Shale Mine effected savings in mining costs. Research progressed at Laramie, Wyo., on high-temperature retorting of oil shale.

For years the Bureau has pioneered in scientific and technologic research on petroleum production and refining. Published reports of Bureau investigations help the industry to increase recovery and improve refining techniques. During the year, engineering studies were published on oil fields in four States, and research progressed on drilling muds, oil-well spacing, electrical well logging, and experimental well shooting. The Bureau's first report on secondary-recovery operations in California was one of 11 published on this type of operation. Over 160 samples of crude petroleum from fields in the United States and abroad were analyzed.

The Bureau produced its billionth cubic foot of helium in 1952. Increased demand for this inert gas forced the Bureau to operate three plants and produce over 130,000,000 cubic feet during the year. Preparing for even heavier demands, the Bureau intensified its search for new sources of helium-bearing natural gas.

Over 1,600 tests were made of permissible and special explosives and hazardous chemicals. Research was continued on blasting methods, ignition of firedamp, and the physics and chemistry of detonations. The Bureau determined the explosive characteristics of numerous flammable liquids and gases and completed an exhaustive study of explosion hazards in hospital operating rooms.

Five major coal-mine disasters claimed 157 lives and boosted the Nation's coal-mine fatality rate to 1.06 per million man-hours exposure for the calender year 1951. Comparison with the 1950 fatality rate of 0.90 emphasized the need for stronger measures and intensified effort in the fight to make United States coal mines safe. The Orient catastrophe, which killed 119 men shortly before Christmas, 1951, was the worst mine disaster since 1928. It underlined the need for corrective action and prompted the Congress to draft the new Federal Coal Mine Safety Act, which became law on July 16, 1952. The Bureau now has authority to control specific conditions that may cause a disaster. Falls of roof and haulage accidents caused between 75 and 80 percent of all coal-mine fatalities during the past 2 years; the Bureau will continue to combat them through its program of research, investigation, and training.

Advice on roof-bolting techniques was given to many mine operators, and by the close of the fiscal year a short coal-mine roof control course had been attended by over 146,000 persons. The Bureau approved a Diesel-electric shuttle car for use in noncoal mines and also approved 76 complete electrical units for use in gassy coal mines. Thousands of samples of mine atmosphere, gas, and dust were analyzed.

The Bureau's safety-training program received widespread recognition in October 1951, when the first national first-aid and mine rescue contest in 21 years was held in Columbus, Ohio. Teams from all over the country, trained in Bureau safety methods, competed for honors in what has been termed "the greatest safety show on earth." The Bureau's accident-prevention courses and motion pictures on safety were attended by thousands of persons during the year.

Federal coal-mine inspectors made 8,693 regular mine inspections, and the Bureau published their reports and notified those concerned of all existing hazards. Many special analyses of injury data were prepared for industry and for Federal and State agencies.

At the close of the fiscal year, the Bureau had controlled 19 fires in inactive deposits and begun the attack on 4 others. So far, over 120,000,000 tons of coal have been saved from destruction, and 94,500,000 tons more will be saved by projects begun in 1952. At current market prices, about $645,000,000 worth of coal has been saved at a cost of less than 1 cent a ton. Attacking the mine-water problem in the Pennsylvania anthracite region, another menace to coal reserves, the Bureau made studies of 93 barrier pillars and estimated costs of a possible drainage system.

The Bureau continued to collect and work toward the improvement of a broad range of statistical data on mineral production and consumption, for the benefit both of the Government and private industry. Statistical data on supply and requirements of individual minerals were analyzed with a view to achieving a sound economic basis for allocating Bureau funds and personnel to commodity research and development programs. Studies of mineral taxation were completed, and work was begun on the first complete mailing list of mineral producing and using establishments in the United States. Research was continued on many phases of the interdepartmental "input-output" project, designed to predict the effects of mobilization plans on the Nation's economy.

Mobilization and procurement problems greatly increased demands for information on foreign mineral supplies. The Bureau continued to furnish information on world production, consumption, and trade in minerals, as well as on United States imports and exports of metals and mineral raw materials.

Participating fully in the Government's foreign technical cooperation programs, the Bureau sent personnel on technical missions to several foreign countries. Many of these missions already have proved beneficial by advancing the economy of the countries concerned and strengthening the mineral supply available to the United States.

By training scientists and engineers from friendly countries in its laboratories and making it possible for them to see American industry at work, the Bureau has done much to increase cooperation among the nations of the free world. During the year, the Bureau provided training for 43 foreign nationals sponsored by various Federal agencies and international organizations. Plans are being made to expand this program during the next fiscal year.

MINERAL DEVELOPMENT

Bureau of Mines research and investigation on metals and nonmetallic minerals in 1952 was directed toward expansion of supplies to meet defense production requirements, essential civilian needs, and accelerated strategic stockpiling. Long-term requirements were not overlooked, however, since the emergency might last for years, with a continuing need for replenishing reserves now being depleted at abnormally high rates.

The Bureau's broad program of investigation and research in mining and metallurgy was carried on during the year in laboratories, in pilot and demonstration plants, and at various field stations throughout the Nation. The aim was to improve methods and processes, develop new ones, and otherwise contribute to efficient utilization of our mineral resources.

The Defense Minerals Administration was abolished early in the year, but its successors, the Defense Minerals Exploration Administration and the Defense Materials Procurement Agency, called for continuance of the Bureau's advisory and consultant services. Bureau mining engineers and metallurgists served on field teams throughout the year, examining mines and prospects and testing ores to determine the worth of ventures for which DMEA and DMPA assistance was sought. Commodity specialists in Washington also collaborated with employees of these two agencies in program development and supplied basic technical, economic, and statistical data.

The President's Materials Policy Commission called on the Bureau's commodity specialists and professional consultants for data and advice in preparing its Resources for Freedom report. The Bureau proved to be the leading source of basic data and technologic guidance on minerals. Long-established services to the Munitions Board, the Emergency Procurement Service, and the Office of International Trade, continued undiminished. To provide industry and Government with information needed in defense mobilization, the Bureau continued to expand its mineral statistical services. Reports were issued more frequently, and data were collected on new phases of industrial activity. The National Production Administration joined in sponsoring new canvasses, which filled gaps in the Bureau's presentation of basic mineral information. Staff members assisted the

International Materials Conference in its search for a practicable and politically acceptable basis for allocating selected strategic metals and minerals among the free nations. The Bureau represented the United States on one of the international commodity committees and cooperated in the preparation of background data for all of them.

The main contract of the Leadville, Colo., drainage tunnel was completed in February 1952, leaving only small repair and improvement operations for succeeding months. This work added 5,250 feet to the ,600 feet completed earlier. Connections were made to three mine shafts, and private exploration and mining activities are in progress in the unwatered areas.

Manganese program.—During the year, the Bureau's manganese research and investigation program was pursued intensively to find new sources of this critical material to meet the requirements of expanded steel production in the United States. It included investigations of ore deposits, tests of new beneficiating processes for low-grade ores, and development of methods to reclaim manganese from steel-furnace slag.

As authorized by Congress, a pilot plant was built at Boulder City, Nev., to run tests on low-grade ores from the Artillery Peak, Ariz., manganese deposits; the results of early experiments showed that material acceptable for making ferromanganese could be produced. At Minneapolis, Minn., the Bureau began construction of a pilot plant to test methods of recovering manganese from the extensive manganiferous ores of the Cuyuna range. This action was based on enocuraging results of laboratory tests of the ores.

At Pittsburgh, Pa., the Bureau conducted experiments to reclaim manganese from steel-furnace slag, building and operating a pilot plant and reporting satisfactory results. A material called spiegeleisen was produced in the first step of a three-step operation, and an oxidizing furnace to be used in the second step was nearing completion. Further experiments in recovering manganese from slag were carried out at the College Park Station (Md.); in a rotary-kiln test, the recovery of manganese from slag was 79 percent.

Among the potential manganese deposits being investigated was the extensive area in Aroostook County, Maine, where Bureau engineers and metallurgists were preparing progress reports on the work done in that section.

Other ferrous metals.—The Bureau's iron-ore projects were planned to insure that the supplies would be adequate to meet the steel-expansion program. Further studies made in connection with the proposed St. Lawrence seaway emphasized the need for obtaining large tonnages of iron ore from the Quebec-Labrador deposits.

Research on recovery of cobalt, nickel, and tungsten from domestic ores progressed during the year. Smelting tests in electric furnaces indicated the feasibility of producing ferronickel from low-grade nickel ores at Riddle Mountain, Oreg. Comprehensive surveys covering all phases of the cobalt and nickel industries were completed and published as volumes of a series sponsored by the National Security Resources Board.

Nonferrous metals.—Continued research on a caustic-leach electrolytic zinc process for treating oxidized ores has renewed the interest of private industry, and a cooperative pilot-plant study is scheduled. Research continued successfully on recovery of pure metals and standard engineering alloys from secondary materials; several processes were tested. Considerable progress was made in developing manganese-copper alloys of high damping capacity for machine components where quiet operation is important.

The Bureau undertook fundamental research on the physical, chemical, and electrical properties of fine particles (slimes) lost in ore dressing. Particular attention was given to the loss that occurs in concentration of certain tin ores.

In a specially designed plant, constructed and operated by the Bureau at Albany, Oreg., substantial quantities of tin were recovered from waste products and returned to the Atomic Energy Commission as pure metal.

Comprehensive reports on zinc and antimony were completed and issued on behalf of the National Security Resources Board.

A Bureau staff member attended the sixth session of the International Tin Study Group at Rome; he later was a member of a United States mission that visited tin producing and marketing operations in Malaya.

Rare and precious metals.—Of the many metals that occur in nature, some have definite and important uses, and others have limited or unknown application. Both groups are scarce; collectively, they are the rare metals.

The first group includes uranium, thorium, columbium, tantalum, selenium, and beryllium. To aid in the search for uranium and thorium, the Bureau, under a contract with the Atomic Energy Commission, has investigated about 40 alluvial deposits in the South and West. These investigations have resulted in actual production operations in several areas. In some areas the investigations also disclosed promising quantities of columbium and tantalum. In others studies are being made, in conjunction with industry, to improve processes for recovering beryllium, columbium, and tantalum from pegmatite deposits. The Bureau, in cooperation with the AEC, helped to test and evaluate some 7,500 samples of ore believed to contain uranium.

A second group of rare metals includes hafnium, germanium, zirconium, gallium, and indium. Bureau metallurgists are studying ways to recover hafnium from zirconium ores and germanium from zinc concentrates. Research is proposed to discover and develop new uses for gallium and indium. The low melting point and lower vapor pressure at very high temperatures of gallium suggest that, despite its corrosiveness, it may be used efficiently as a heat-exchange medium in atomic-energy plants.

Light metals.—Rapidly expanding aluminum production and increasing dependence on foreign bauxite make utilization of domestic aluminous materials increasingly important. At Laramie, Wyo., the Bureau soon will begin operation of an experimental alumina plant to demonstrate the practicability of producing alumina from anorthosite rock and from other domestic aluminum silicate deposits. This is the final step in a long-range Bureau study to develop industrial processes for producing aluminum from raw materials other than bauxite. The Laramie plant has been renovated, and construction necessary to operate it as an independent unit was approaching completion during the third quarter of 1952. This project is designed to make a complete technologic and economic appraisal of the alkaline-sinter processes based on operation of industrial-scale equipment.

Research on direct carbothermic production of aluminum-silicon alloys from clay, in cooperation with a privately owned smelting company, resulted in production of 31,000 pounds of aluminum-silicon alloy of various grades. This was used as a master alloy in producing commercial alloys. As a result, the company intends to construct a small smelter for producing aluminum-silicon alloys in Lane County, Oreg. A study of methods for beneficiating domestic low-grade bauxites by selective removal of objectionable impurities, especially silicon, was continued, with a simultaneous study on recovery of valuable constituents, such as titania and columbium.

Knowledge of the properties of magnesium alloys will increase the uses of this metal and permit its substitution for more expensive and more critical ones. The Bureau is investigating the physical metallurgy of manganese alloys, particularly lightweight magnesium-lithium-aluminum alloys, to develop and improve melting and alloying techniques and heat treatments.

All titanium-metal sponge produced commercially in the United States is obtained by using modifications of a Bureau process, which is commercially feasible but expensive. Bureau research is directed toward improved production techniques and equipment design, production of purer metal, development of fabrication techniques, and a knowledge of the properties, alloys, and compounds of a metal. In cooperation with the Department of Defense, special high-purity sponge was produced for use at the Watertown Arsenal, and prototypes, such as mortar base plates, flash suppressors, and muzzle brakes, were fabricated from titanium and delivered to Army Ordnance for field tests. The Bureau analyzed for compliance with Federal specifications all samples of titanium sponge submitted for purchase by the General Services Administration.

Nonmetallic minerals.—The Bureau expanded its work on sulfur during the year to help solve the serious problems of a shortage of this commodity. As information on the sulfur resources of the United States is sketchy and scattered, studies were begun to provide for each region a comprehensive report showing sulfur resources and prospects of development. Field and laboratory investigations were conducted on a Minnesota sulfide deposit and on several other possible sulfur sources.

The Bureau continued its field and laboratory investigation of mineral construction materials in the Alaska rail-belt area.

Because of the growing demand for fluorine, the Bureau continued its research, including laboratory and pilot-plant tests, on economical methods of separating fluorine from phosphate rock. One method tested uses water vapor and heat to recover both fluorine and vanadium. Further work is planned, with various types of furnaces and with fluidization techniques. A number of fluorspar deposits were also investigated. Research was continued on development of hard borides and carbides, needed for high-temperature abrasives and as substitutes for industrial diamonds. Various raw materials were tested to determine their utility in producing mineral wool. Development of relatively small but high-grade asbestos deposits in Arizona is being encouraged, and other promising areas, especially in California, are being examined. Research on asbestos synthesis was continued, and a comprehensive volume on asbestos, prepared by the Bureau for the National Security Resources Board, was published.

The Bureau has made considerable progress in developing and testing raw materials and fabricated mullite-type refractories to replace imported kyanite and equivalent materials. Siliceous bauxite from domestic sources holds promise as an economical material for mullite refractories. Future work planned is the discovery of domestic raw-materials sources and their most effective utilization in mullite-type refractories. The Bureau is a participant in interagency and industry committees dealing with problems of strategic mica supply; at the Bureau's request, the National Academy of Sciences is preparing reports on electrical testing of mica and on the potentialities of reconstituted mica and synthetic mica. Nearly 5 years of the Bureau's synthetic-mica program, in cooperation with the Navy, has been completed, but the project will be continued under Army Signal Corps funds, supplemented by Bureau allotments. It has been demonstrated that synthetic mica flake can be disintegrated and reconstituted to form large sheets, which promise to replace the best quality of strategic mica in many applications.

To reduce United States dependence on foreign sources of block steatite talc, substitutes have been developed. Final tests and evaluation are not complete, but preliminary results are promising. Pressed steatite blocks were made, using various binders, and various methods of beneficiating off-grade talcs were tried. As a byproduct of synthetic-mica research, the Bureau has developed an ultra-low-loss machinable dielectric from hot-pressed synthetic mica.

Miscellaneous research on minerals.—Searching for new methods to increase the effectiveness of fundamental research on minerals, the Bureau developed techniques whereby the fluorescent, X-ray spectrograph can be used as a routine analytical tool with an accuracy that surpasses optical spectrographic methods.

Application of thermodynamics to mineral and metallurgical problems has revealed the general pattern of chemical and physical processes and permits prediction of their course. Accordingly, the Bureau continued to measure and correlate thermodynamic properties of metals and nonmetallic minerals.

Research on fundamental variables and operating techniques of diamond and core drilling was continued during the year. Performance tests on various orientations of diamonds in diamond-set bits were made, and the relationship and orientation of cutting edges and facets to rock penetration and bit wear were studied.

In the application of physics to mining problems microseismic instruments were developed by the Bureau and used to measure stresses and strains in the wall and roof rock of two iron mines and one copper mine in Michigan and of a zinc-lead mine in Oklahoma. Study of the physical properties of various types of rock helped to determine effective roof-bolting procedures and will provide data on which mining methods and allied techniques can be based. In cooperation with the Corps of Engineers, a series of underground explosives tests was made to determine damage resulting from blasting.

Research on mineral-dressing techniques promised improvements that will increase recoveries and simplify difficult mineral-separation problems.

RIVER-BASIN ACTIVITIES

Under the Department's river-basin program, the Bureau is carrying on mineral-resources investigations in several project areas. Planned in cooperation with the States and other Federal agencies, Interior's long-range program is aimed at wise development and utilization of all resources in the several river basins of the United States.

Arkansas-White-Red River Basins.—A survey of mineral industry and mineral resource potential is progressing in the Arkansas-White-Red River Basins of Kansas, Missouri, Oklahoma, Colorado, New Mexico, Arkansas, Texas, and Louisiana. Eleven reports have been submitted for use in preparing a resources-development plan for the basins, and nine others are nearly complete. Bureau engineers made detailed studies of mineral resources and industries in the Washita River subbasin and began similar work in the Ouachita subbasin.

Missouri River Basin.—To insure proper utilization of the Missouri River Basin's resources, the Bureau is investigating mineral occurrences and studying their development and use. Reports were presented on chromite resources, ferrous metal, and bentonite deposits in Montana, Wyoming, and South Dakota, pegmatites in Colorado, and mineral resources of the North and South Platte River Basins, western Kansas, the Powder River Basin, and four Montana counties. Studies were progressing on the mineral resources of eastern Kansas and on nonmetallic minerals in several Missouri counties.

Data on mines and ore deposits in the Black Hills of South Dakota were compiled and summarized, and effects of blasting on green concrete at the Oahe Dam site were studied.

New England-New York survey.—Surveys and 25 commodity reports were made on mineral resources and mineral industry of the New England-New York area. When complete, these reports will cover over 50 commodities, important in the area's economy.

Other river basins.—Work is also being started in Alaska, the Pacific Northwest, Colorado-Great Basin, and California.

FUELS AND EXPLOSIVES RESEARCH

Special services.—The President's Materials Policy Commission called on the Bureau's fuels specialists for data and advice in preparing its report on Resources for Freedom, particularly with respect to changing patterns of fuel consumption and technological developments. The data prepared by the respective fuels specialists also were used extensively by other governmental groups and private organizations, particularly the defense agencies, for basic information regarding the operations and outlook of the mineral fuels industries of the United States and fuels production and requirements abroad.

Coal and Coal Products

Coal mining and investigations.—Operation in bituminous-coal mines of various types of American and British continuous coal-mining machines was studied. In a cooperative test of an imported German coal planer, the planet cut coal from a longwall face of a test panel and simultaneously loaded it on a conveyor belt. This machine increased percentage recovery of coal, increased production per man-shift, and reduced costs and material. Studies of pillar extraction with mechanical equipment continued, and two methods of increasing production and recovery in thick, steeply pitching anthracite beds were successfully demonstrated.

Known minable reserves of coking coal were determined for 4 additional Pennsylvania, West Virginia, and Kentucky counties, and data are being obtained for 12 other counties in those States, Maryland, and Tennessee.

Coal preparation.—Reports on the possibilities of cleaning coals to meet metallurgical standards were completed for four counties in Pennsylvania and three in Kentucky. Many coals in these counties can be upgraded for metallurgical use by appropriate washing.

A simple device was developed for continuously measuring the density of liquids used in heavy-medium coal-washing plants, and a study of launder screens for cleaning anthracite fines gave design data for a pilot test unit.

Coking, gasification, drying, and combustion studies.—Carbonizing tests indicated that coals from western counties in Virginia would make good metallurgical coke if blended with small amounts of low-volatile coal. Other coals from Kentucky, Alabama, West Virginia, and Pennsylvania showed good carbonizing properties; but, in general, the coking qualities were improved by blending with other coals.

The first unit of the initial commercial application in this country of the Bureau-developed fluidized process for upgrading low-rank coals to produce char for power generation and coal chemicals for industrial use was completed at Rockdale, Tex. Fluidized drying and carbonizing tests in the Bureau's pilot plant yielded chars for power generation and tars and coal chemicals from noncoking fuels ranging from sawdust to the best of the subbituminous coals.

Gasification tests on anthracite-bone coal-breaker refuse showed that, while gasification was possible, specially designed equipment would be needed to handle the large volume of ash. Investigation of waste combustion in incinerators developed a vortex design that minimizes smoke and emission of particulate matter.

Services to the Government.—Bureau advisory services continued to aid Federal agencies in improving efficiency of fuel-burning equipment, lowering over-all costs, and selecting proper fuels. Research continued on preventing corrosion and deposits in boiler-plant airpreheaters; 42 different Federal agencies were assisted on 152 special problems.

Over 1,223 tipple samples were collected at 440 coal mines for the Federal coal-purchasing service and Bureau research work. In all, 12,070 analyses of coal, an increase of more than 10 percent over last year, were reported to various Federal agencies. Over 11,200 samples of boiler water were analyzed, and recommendations for treatment made. Many Federal plants were visited, and assistance was given on special boiler-water problems. Bureau research to determine cheaper chemicals for preventing return-line corrosion has saved thousands of dollars on the cost of chemicals for this purpose.

Smoke-abatement consulting service was given to seven cities, and work continued on an international problem of air pollution in the Detroit River area.

Stream-pollution investigations solved a sulfuric-acid-disposal problem arising from coal-pile drainage at Bainbridge Naval Training Center, Md., at a cost $200,000 less than that of other proposed solutions. The pollution difficulties of a magnesium plant operated by the General Services Administration are being studied.

Coal economics.—During the year, the Bureau's statistical and economic data on coal, coke, and coal chemicals have provided the Defense Solid Fuels Administration with information fundamental to operations of the defense-emergency programs for these commodities. Studies were made of trends and casual factors in production, consumption and exports. Changes in fuel-energy consumption patterns and factors influencing these changes were analyzed. The work program also included assembling and interpreting highly complex data for forecasting requirements necessary to provide adequate fuel supplies to meet needs of both military and civilian economy.

SYNTHETIC LIQUID FUELS

Significant progress was made with new processes developed by the Bureau in synthesizing oil from coal-derived gas and for retorting oil shale. Industry and other Government agencies became interested in applying synthetic-fuel developments, especially coal gasification, to the production of pipeline gas from coal, synthetic ammonia for fertilizer, and industrial chemicals. During the year, a survey by an independent engineering firm substantially supported many of the items in the Bureau's cost estimates on coal hydrogenation.

Oil from coal.—Three complete runs were made in the first year of operation of the newly completed gas-synthesis demonstration plant at Louisiana, Mo., producing chiefly gasoline and Diesel fuel. Capable of producing from 50 to 80 barrels of liquid product daily, the plant proved the technical feasibility of the Bureau's modified Fischer-Tropsch process. Conversion rates were satisfactory, and the oper-ability of the equipment and apparent durability of the catalyst were demonstrated.

Three extended liquid-phase runs were made on Western Kentucky No. 11, Illinois No. 6, and Lake De Smet, Wyo., coals, and one vapor-phase run was made on distillate from Western Kentucky coal. Over a million gallons of middle oil has been produced, and about 600,000 gallons of gasoline of acceptable octane rating has been tested satisfactorily by the Military Establishment. Experience gained in the demonstration plant has been invaluable in developing new equipment and processes and in providing data to improve the economics of coal-hydrogenation operations.

In laboratory and pilot-plant research at Bruceton, Pa., coal-to-oil advances were made in producing liquid fuel from synthesis gas and by hydrogenation of coal. An autoclave study of coal hydrogenation indicated that this complex reaction may be considered a two-step process in which coal is first converted to asphaltene and then to oil. Tests on upgrading shale-oil coker distillate by hydrogenation to produce jet fuel and Diesel oil meeting military specifications indicate merit for economical large-scale application.

In the synthesis-gas laboratories at Morgantown, W. Va., continuity of operation of a pressure gasifier neared realization, and a number of short runs showed a high capacity of synthesis gas produced per unit of generator volume. Ground was broken late in the fiscal year for a new $2.6 million experiment station to be ready for occupancy in fiscal year 1954.

Good-quality gas was produced during most of the 10-month operation of the third experiment on the underground gasification of coal concluded on May 7 at Gorgas, Ala., in cooperation with the Alabama Power Co. A new technique, known as the electrolinking process, eliminated underground work in the third test. Interest in this work heightened as the Bureau and the Alabama Power Co. cosponsored the First International Conference on Underground Gasification of Coal during the year.

Oil from oil shale.—Investigation of the Bureau of Mines gas-combustion process progressed from the pilot-plant to demonstration-scale stage during the year at Rifle, Colo., and construction was begun on a 300-ton-a-day plant to be completed during fiscal year 1953. Good yields are obtained from this relatively simple and continuous process for retorting oil shale, which also provides low-B. t. u. gas for all of the necessary heat and eliminates the need for exterior heat-exchange equipment and cooling water. Tetraethyllead blending facilities added to the oil-shale refinery made it possible to produce shale-oil gasoline suitable for Bureau vehicles, and shale-oil Diesel fuel continued to give satisfactory service. Refining operations showed that conventional thermal refining techniques can be adapted to the processing of shale oil. Detailed cost estimates for a nominal 250,000-barrel-a-day industry-scale oil-shale plant indicated economic operation using either recycle thermal cracking or a mild hydrogenation process.

By using rotary instead of percussion drilling at the Oil-Shale Experimental Mine, Rifle, Colo., higher drilling rates were achieved and savings effected in bit and drill-rod costs and in labor and in power. Analysis of cuttings gathered from wells drilling in oil-shale formations in Colorado, Utah, and Wyoming provided added data for determining the extent, depth, and thickness of oil-shale deposits in the Rocky Mountain States.

Progress in research on high-temperature retorting of oil shale at the Oil-Shale Experiment Station, Laramie, Wyo., resulted in the installation of large bench-scale equipment for testing oil-shale fines by an entrained-solids process. High-temperature retorting offers the advantage of producing aromatic materials that can be used to upgrade shale-oil gasoline and for manufacture of chemicals.

PETROLEUM AND NATURAL GAS

Petroleum and natural-gas production.—The Bureau has completed its part of cooperative engineering and geologic studies in Scurry and adjacent counties of Texas under an agreement with the Geological Survey and the Petroleum Administration for Defense. Six reports are or soon will be completed supplying data concerning the fields and the availability of petroleum and natural gas. Special aid was given the Navy Department in its exploratory drilling in Naval Petroleum Reserve No. 4, Alaska.

Engineering studies relating to the Missouri, Arkansas, and Washita River Basin projects continued, and Bureau engineering reports were published on oil fields in West Virginia, Pennsylvania, Texas, and Oklahoma. Studies of drilling muds, oil-well spacing, electrical well logging, and experimental well shooting are progressing, and encouraging laboratory tests on plugging of highly permeable sands with chemical smoke were carried out. Cooperative projects on gas-condensate fluids and research on the flow of natural gas in high-pressure, high-velocity pipelines are nearly completed.

Fostering improved secondary recovery in the Appalachian and Mid-Continent areas, the Bureau published 11 reports, including its first report on secondary-recovery operations in California.

Petroleum chemistry and refining; thermodynamics.—Analytical and research data on properties and combustion qualities of crude oils and petroleum fractions have been obtained. A publication summarized present knowledge of the sulfur content and sulfur compounds in crude petroleum, and 162 samples of crude petroleum from the United States and foreign countries were analyzed. Over 200 crude oils have been analyzed for their content of nitrogen and the results published.

The effects of additives and of synthetic atmospheres on the combustion of Diesel fuels were determined. Storage instability and incompatibility of more than 3,500 samples of fuel oils and Diesel fuels are being studied. Twenty pure organic sulfur compounds were prepared and are for sale to other laboratories as standards for calibrating analytical instruments and for other important uses. Results of Bureau wartime research on aviation gasolines were published, and the availability of aircraft fuels was studied. Studies of oil-soaked sand deposits in Utah indicated that good yields of oil could be recovered and that the deposits represent about 2 billion barrels of oil reserves. New methods and apparatus for analyzing petroleum fractions have been developed. Thermodynamic data for engineering and laboratory research were made available for over 20 organic compounds.

Petroleum and nautral-gas economics.—During 1951 new records were established in nearly all phases of the petroleum industry. Crude-oil production was 10 percent above the previous record, that of 1948. Runs to stills also were up 14 percent from 1950, the previous record year; imports of crude oil and products were slightly below 1950; exports were up 39 percent. Domestic demand for all products was 8 percent greater than in 1951. Wells completed during 1952 represented an increase of 2 percent over 1951.

Proved recoverable reserves of crude petroleum increased 2,200,000,000 barrels during 1951 to 27,468,031,000 barrels. Almost 2 barrels of crude oil were added for each barrel produced. Expropriation of the Anglo-Iranian Oil Co. by the Government of Iran in June 1951 removed from the world supply some 650,000 barrels per day of crude-oil production and 500,000 barrels of refining capacity. By rearrangement of supplies and adjustment of refining activity throughout the world, the immediate impact of this action was minimized. Increased production, principally in other Middle East countries, offset the Iranian loss almost entirely. New European refining capacity plus maximum use of existing capacity compensated for much of this loss. Drilling must be increased even more to meet the continually rising demand. A goal of 80,000 producing wells set for the 18 months ending December 31, 1953, may not be reached because of reduced manufacture of drilling equipment and material, owing to the steel strike.

HELIUM

The Bureau produced over 130,000,000 cubic feet of helium for Federal agencies and private customers in 1952, an increase of more than 30 percent over the previous year. Demand for helium by non-Federal customers reached an all-time high of 40,000,000 cubic feet. The most important use of helium by private industry continued to be its employment in helium-shielded arc welding.

The Navajo helium plant at Shiprock, N. Mex., remained in standby status, but preliminary plans are being made to reactivate it in 1953. Also, renewed emphasis is being directed toward finding and investigating new sources of helium-bearing natural gas. Additional production facilities will be needed in 1954 or 1955 if the demand for helium continues to increase at the present rate.

The Bureau continued its research aimed to improve the production, distribution, utilization, and conservation of helium. One important development in 1952 was the use of liquid nitrogen at subatmospheric pressure as a coolant in the purification cycle.

EXPLOSIVES AND EXPLOSIONS RESEARCH AND TESTING

Explosives research.—The Bureau made 1,659 tests of permissible and special explosives and hazardous chemicals during the year. Five permissible explosives were put on the inactive list, and one was transferred from the inactive to the active list, leaving 174 on the active list. About 3 percent less permissible explosives was used in coal mines than during the previous year, and the ratio of black blasting powder to permissibles (less than 10 percent) was the lowest in history.

Understanding of the mechanism of ignition of firedamp by stemmed and unstemmed explosive charges has been advanced. Safer and more efficient stemming materials have been sought for use with permissible explosives. Research has been completed on the hazards of short-delay multiple blasting of coal. Research on blasting methods has continued, and fundamental research progressed on the physics and chemistry of detonations.

As part of the Bureau's search for more efficient and stable primary explosives, a number of promising nitramines and substituted nitroguanidines were synthesized and tested.

Gas- and dust-explosion research.—Continuing its efforts to eliminate dust-explosion hazards, the Bureau tested 80 different dusts. The effects of various dusts in venting dust explosions were considered. Related fundamental research has improved understanding of the mechanism of the propagation of dust explosions. Research on rock dusting in coal mines was continued.

The Bureau determined the explosive characteristics of a number of flammable liquids and gases and studied the causes of several industrial explosions on the scene. Investigation of the ignition and explosive hazards of certain aircraft fuels, both as vapors and as sprays, has continued. A study of the inerting effects of certain gases on the flammable limits of these fuels has been initiated. An extensive study of explosion hazards in hospital operating rooms was completed.

Progress is continuing in fundamental research on ignition and flame própagation, and the experimental technique of measuring burning velocity has been improved. Studies of combustion instability of appliances resulting from the substitution of one fuel for another have benefited the fuel-gas industry.

SAFETY AND HEALTH ACTIVITIES

Research, investigation, training, and inspection of individual coal mines are the means by which the Bureau promotes safe and healthful conditions in the mineral industries. With passage, shortly after the close of the fiscal year, of the new Federal Coal-Mine Safety Act, the Bureau assumes even greater responsibility in future than in the past. However, the excellent relations that have been established with State mining departments and mine operators' and workers' organizations and the experience gained during 41 years of health and safety work offer a reasonable expectation of continued success in this field of endeavor.

Work on primary hazards.—Between 75 and 80 percent of the fatalities and about 45 percent of all injuries in American coal mines during the past 2 years have been caused by falls of roof and coal or by haulage accidents. In line with its policy of concentrating upon the hazards that are most serious at any given time, the Bureau continued its vigorous campaign to solve roof-control and haulage problems.

An outstanding result of the Bureau's roof-control work is the rapidly increasing use of steel roof bolts as a substitute for wooden timbers in mine-roof support. Since 1947, when the Bureau first began sponsoring their use in coal mines, roof bolts have proved so economical and effective that their use has spread quickly. To date, 562 coal mines and 73 noncoal operations are using them. Services of Federal coal-mine inspectors trained in roof-bolt installation are in constant demand by the industry.

Torquemeter and pull tests to determine the holding strength of various types of roof bolts were made in mines in 12 different States during the year. Other roof-support work by the Bureau included a time study in a Pennsylvania mine to gather data on the efficiency of current methods, a study of roof movement along a pillar section of a West Virginia mine, field tests to determine the effectiveness of various roof paints as roof-control agents, and laboratory tests to discover the state of strain in specimens of rock taken from mines where roof bolts are used.

A short coal-mine roof-control course for mine workers and officials, initiated in 1951, was continued and has so far been attended by over 146,000 persons.

To reduce haulage accidents, which comprise about 25 percent of all coal-mine fatalities, the Bureau in April 1951 introduced a short course in coal-mine haulage safety. The course is given by coal-mine inspectors in half-hour lectures at the close of each Federal inspection. To date, 80,624 haulage employees and other mine personnel have attended these lectures.

Information gained in Bureau investigations of all coal-mine fatalities is condensed and published semiannually to furnish the facts needed for planning more effective accident-prevention programs.

Tests of equipment.—During the year the Bureau continued to test mining electrical machines and appliances to make sure they are constructed to minimize electric shock and gas- and dust-ignition hazards. It investigated Diesel-powered mine locomotives and equipment to determine their safety for use underground and, under Bureau Schedule 24, approved a Diesel-electric shuttle car, the first piece of Diesel equipment approved by the Bureau for use in noncoal mines.

The Bureau also approved 76 complete electrical units for use in gassy coal mines, indicating the increasing demand for permissible mining equipment and roof-bolting drills.

Special investigations were conducted to aid the Navy Department in reducing fire and explosion hazards resulting from the use of electrical equipment on vessels and aircraft where gasoline fumes are present.

Health studies.—During the fiscal year, the Bureau's efforts to improve health conditions in the mineral industries centered on the study and evaluation of atmospheric conditions or contaminants. Analyses were made of nearly 14,000 samples of mine atmosphere and other gaseous mixtures, collected during inspections and investigations of coal, metal, and other types of mines, and tunnels. Results of these analyses aid in correcting existing hazards and provide information for controlling mine gases and dusts and improving mine ventilation.

Approximately 1,000 samples, collected in mines and industrial plants, were examined to determine concentration and particle size of air-borne dusts and the composition of dusts and dust-source materials. An investigation was conducted to determine the concentration of dust in the breathing zone of men drilling rock in coal mines, and a Bureau of Mines schedule was developed for approval of dust collectors used in rock drilling.

Three new approvals and 25 extensions of approval were granted on respiratory protective devices, and numerous check tests were made on approved respiratory protective devices purchased in the open market.

Information on mine and tunnel ventilation, mine air conditioning, and various air-flow problems was supplied to industry and to other Government agencies. Publications on electrical accidents and dust and ventilation studies were issued during the year, and work continued on a bibliography of atmospheric pollution literature, for which 4,100 articles have been abstracted during the past 2 years.

Safely training.—Realizing that teaching supervisors and workers how to recognize dangerous conditions and practices and how to eliminate them is a potent remedy for accidents, the Bureau is constantly revising its training courses given at mines and plants during the past 41 years and adding new, specialized courses to those previously taught.

Since the Bureau's revised coal-mine accident-prevention course for miners was introduced 5 years ago, 59,126 miners have completed it, and over 15,000 persons have completed the course for supervisors. Over 1,000 mining officials in 14 States studied the Bureau's accident-prevention course for metal miners during the year, and 206 persons attended a course in safety instruction conducted in Texas and Canada for workers in the petroleum industry. During the year, 33,722 persons in the mining and allied industries were given a full course in first aid and 2,306 the course in mine rescue methods.

Demonstrations and lectures on the hazards of petroleum products and the explosibility of gas, coal dust, and other mineral substances were presented before 69,209 persons in many States, and an estimated 81,760 spectators witnessed the 49 first-aid and mine rescue contests in which Bureau safety personnel actively assisted.

The first national first-aid and mine rescue contest in 21 years was held in Columbus, Ohio.

Sound motion pictures showing safe methods of blasting and timbering in mines and safe operating procedures on oil-drilling rigs were seen by 38,514 persons during the year.

Coal-mine inspections.—During the eleventh year of Federal inspection of coal mines under Public Law 49, Seventy-seventh Congress, 8,693 regular mine inspections were made, increasing the number of inspections made under the law to 50,679. Comparison of injury rates before and after 1941, when the law became effective, reveals the competent work done by all concerned in achieving the principal objective of the law—reduction of coal-mine accidents.

The first 10 years of Federal inspection saw fatalities in the anthracite mines of Pennsylvania reduced 33 percent, the fatality rate 31 percent, nonfatal injuries 37 percent, and the nonfatal-injury rate 26 percent compared with the 10 years before the law went into effect. Comparable figures for the Nation's bituminous-coal and lignite mines show that fatalities were reduced 11 percent, the fatality rate 20 percent, nonfatal injuries 6 percent, and the nonfatal-injury rate 16 percent.

Records show that, since Federal inspection began, 2,055 coal mines have adopted systematic roof-support plans, 1,208 have stopped using dangerous black blasting powder, 2,302 have installed new main fans, and 939 began using water to allay dusts. In addition, preshift examinations for gas were begun in 2,366 mines, 1,548 mines were rock-dusted for the first time, 1,363 banned smoking, and 1,219 stopped the use of open lights.

Despite these improvements, seven major coal-mine disasters occurred between January 18, 1951, and June 30, 1952. The Orient disaster, which killed 119, prompted the Congress to approve legislation that gives Federal inspectors authority to control dangers that may cause a major catastrophe. When the President signed the bill on July 16, 1952, the new Federal Coal Mine Safety Act, Public Law 552, Eighty-second Congress, became law.

The Bureau's plans for 1953 include continuation of its educational program, continued investigation of all coal-mine fatalities and disasters, and administration of Public Law 552, as well as inspections under the new law.

Special investigations.—Investigations to determine the primary causes of mine explosions and fires are among the most important Bureau activities, because through these, knowledge of how to prevent the disasters that each year destroy lives and property is gained and passed on to industry and to other persons working for safety.

During the fiscal year, Bureau personnel investigated 34 mine explosions—5 of them major disasters—and 34 mine fires. Thorough investigations were made of numerous miscellaneous accidents.

The Bureau conducted 116 health and safety investigations. In these studies, mining practices, conditions, and equipment were examined, and samples of mine air and dust analyzed.

A cooperative study of the occurrence of mercury in pipelines from a California oil field was continued during the year.

In addition to tests of mine timber treated by conventional methods, a new procedure for impregnating living trees is being studied in Washington State.

Accident analysis.—Decentralization of accident-analysis work in accordance with the Bureau's regional plan was nearly completed at the close of the fiscal year. Records, files, and equipment were transferred from Washington to the various regions, and regional personnel were specially trained on procedure and outline of canvass work in gathering injury, production, and employment data.

Mounting interest in accident prevention prompted an increased demand for the Bureau's reports on injury records in the mineral industries, and everything possible was done to issue them currently. Many special analyses of injury data were prepared for Federal and State agencies, mine operating companies, labor organizations, and mineral producers groups.

A record total of 1,010 plants enrolled in safety competitions for 1951. The Bureau sponsored and conducted the twenty-seventh national safety competition and the second national sand and gravel, competition, and also conducted competitions for several other national associations.

Control of fires in inactive coal deposits.—From 1949 to the close of the fiscal year, the Bureau of Mines had controlled 19 fires in coal deposits not now being mined and begun the attack on 4 others. Of the fires already controlled, 11 were on the public domain in Colorado, New Mexico, and Wyoming, and 8 were on private property in Pennsylvania and West Virginia.

Over 120,000,000 tons of anthracite and bituminous coal have been saved from destruction by fire as a result of the Bureau's fire-control program during the 3-year period 1949–51, and an additional 94,500,000 will be conserved by projects started in 1952. At current market prices, this coal would have an estimated value of $645,000,000 if mined. This saving has been accomplished at an estimated cost of less than 1 cent a ton.

The Bureau has a record of 52 additional coal-crop fires now burning in Wyoming, Colorado, New Mexico, and Utah. Only preliminary examinations have been made of most of these fires, and no estimate is available of the amount of coal imperiled. Some of the fires are on Federal land, some on State land, and some on private land. Surveys have been made of several large fires to permit control work as the weather and funds permit.

Anthracite flood prevention.—Bureau engineers continued to study the mine-water problem in the Pennsylvania anthracite region last year. Investigations of 93 barrier pillars in the Lackawanna Basin of the Northern field and of 81 barrier pillars in the Western Middle field of the anthracite region were completed and reports prepared as Bureau bulletins.

Investigations of barrier pillars in the Wyoming Basin of the Northern field and in the Southern field are proceeding. These investigations are concerned with the physical condition of each barrier pillar, its capacity to withstand hydrostatic pressure, and its relationship to the safety of men working in active mines.

All available data from Federal, State, and private-company sources were correlated into one report to facilitate study of the acid-water problem and to indicate possible solutions.

A study of surface infiltration and its relation to pumping loads over the entire Lackawanna Basin indicates that surface diversion of rain water can afford only limited assistance.

Estimates of construction quantities and costs were made of a possible drainage system from Conowingo, Md., to above Scranton, Pa., to drain water from the Northern, Western Middle, and Southern fields. Diamond-drill cores were taken from holes along such a tunnel line to give some basis for cost estimates for shaft sinking and tunneling through this strata.

As part of a report to the Congress, estimates are being prepared of 12 different tunnel schemes that have been proposed during the past 10 years.

FOREIGN ACTIVITIES

Activities of the Bureau outside the United States and Alaska are carried on by a regional director (region IX) and his staff in Washington. This group is responsible for providing basic statistics, information, and analyses on foreign mineral supplies and for supervising the Bureau's mining, metallurgical, and mineral-resource operations abroad.

With greatly increased demands for assistance from other defense agencies, the Bureau's foreign minerals fact-finding services continued to help meet the problems arising from the rapidly growing dependence of United States economy on foreign sources of raw-material supply. Through its statistical units, the Bureau provides data on world production, consumption, and trade in minerals, as well as on United States imports and exports of metals and mineral raw materials. These data are published and distributed regularly in monthly, quarterly, and annual mineral market surveys and in the Minerals Yearbook. Careful surveillance of all available sources of statistical information and a world canvass by questionnaire insure maximum reliability of data.

Divided into five geographical sections—North America, Latin America, Europe, Africa, and Asia—the Bureau's region IX maintains extensive files of data collected from innumerable sources, including the United States Foreign Service. The Bureau is responsible for technical supervision of mineral attachés in the Foreign Service and recruits staff, prepares instructions to foreign reporting officers and appraises the quality of reports and performance of minerals attachés and other State Department foreign reporting officers. Despite the United States' dependence on raw materials from abroad, the Government presently employs only five mineral attachés, and the Bureau has continued to advocate expansion in the minerals attaché service.

During 1952, the Bureau expanded its participation in the Government's foreign technical-cooperation programs, particularly the point 4 program administered by the State Department's Technical Cooperation Administration. The Bureau's success in this work stems from its insistence upon providing complete technical support for personnel abroad through consultation with specialized experts at home.

Cooperative foreign projects begun before and continued through the fiscal year included technical missions in Afghanistan, India, Nepal, Brazil, Colombia, and Mexico, all under the point 4 program. Work was continued also on an oil-shale project financed by the Brazilian Government.

Cooperating closely with United Nations organizations, the Bureau has detailed personnel to special assignments on U. N. mineral resources programs, and personnel also has been loaned to Mutual Security Agency. In 1952, Jordan joined the countries participating in point 4, and the Bureau undertook a project in Cuba for the Defense Materials Procurement Agency. The same or expanded point 4 programs are expected to continue during 1953, and the Bureau also plans to cooperate further with MSA and DMPA.

Technical missions range from general mineral surveys to practical, operational development to expand or initiate industrial activity for the economic benefit of the country, improve international relations, and eventually strengthen mineral supply to the United States.

Nepal has asked the Bureau's cooperation in cataloging its mineral resources as an effort toward restoring an ancient mining industry in terrain probably never before explored by foreigners. In Bolivia, progress has been made in research on low-grade tin ores. Efforts of the Mexican Comision de Fomento Minero and the Bureau stimulated private investors to complete facilities to produce acid-grade fluorspar near Taxco, Mexico. Afghanistan has expressed appreciation for the Bureau's guidance in expanding a badly needed coal industry, as well as for its prompt and effective response in extinguishing three coal-mine fires. Brazil had advanced in coal preparation, hopes soon to establish an oil-shale industry, and contemplates development of a phosphate deposit in cooperation with the Bureau. These examples typify accomplishments in foreign technical cooperation.

Another important phase of the Bureau's international activities is the program under which foreign engineers receive specialized advance training in the United States, usually at Bureau of Mines field stations. During the fiscal year, the Bureau trained 43 foreign nationals sponsored by TCA, U. N., MSA, and other organizations. This program was facilitated by industry's willingness to permit visitors to observe equipment and operations at plants and installations throughout the country. Present indications suggest expansion of this important phase of technical cooperation.

MINERAL ECONOMICS

The Bureau broke new ground during the year by way of systematic analysis of minerals-policy problems, coordination and improvement of its machinery for gathering statistical data, and basic research in interindustry economics. This program was carried on by the newly established Office of Chief Economist.

Basic research on taxes by the Bureau helped pave the way for an Internal Revenue Code provision for "expensing" outlays on mineral exploration. Also completed were a fundamental reference study on mineral taxation in the United States and an initial comparative study of United States and Canadian tax structures.

The Bureau did important preparatory work for the United States trade-agreement negotiations with Venezuela and supplied a member of the United States negotiating team.

In order to develop economic criteria for the most effective use of Bureau research funds, economic review of planned Bureau programs for technical research and exploration was undertaken. Emphasis was placed on evaluating future supply and requirements for individual minerals.

Every effort was made to assist the President's Materials Policy Commission by supplying statistical and economic data and analyses.

Close contact with other Government agencies was maintained throughout the year to assure coordination and prevent duplication of work on statistical canvasses. Arrangements were made to collect many of the data needed for the Defense Mobilization Program and, in cooperation with the Bureau of the Census, preliminary plans were laid for the 1953 Census of Mineral Industries. Proposed schedules and procedures for this and other 1953 censuses were reviewed to help insure statistics of the greatest possible usefulness to industry and Government.

Development of a unified establishment list was undertaken during the year. Arrangements were made to collect the various Bureau mailing lists for comparison with lists maintained by other agencies to set up a complete mailing list of all mineral producing and using establishments.

Research continued on various phases of the interdepartmental "input-output" project designed to predict the effects of mobilization plans on the mineral industries. Detailed analyses were made to determine the amount of equipment that the Nation will require in 1952–55 in copper mining and milling, alumina, primary aluminum, and aluminum rolling and drawing, to meet the planned expansion program. "Planning factors" to measure mobilization demands have been computed for these and other industries. With the cooperation of the National Research Council and the Department of Defense, statistical equations were prepared to estimate requirements for a dozen critical materials.

PUBLIC REPORTS

As its organic act directs the Bureau of Mines to prepare and publish reports of inquiries and investigations, information on its activities is made available in printed and processed reports issued by the Bureau, and in articles published by technical societies. During the year, 630 manuscripts were approved and edited, compared with 589 during the fiscal year 1951.

Printed publications totaled 89, including 14 bulletins, 61 Minerals Yearbook chapters, and 14 miscellaneous items. There were 194 processed publications, including 111 reports of investigations, 29 information circulars, 15 Mineral Trade Notes and Supplements, 7 National Security Resources Board discussions of important minerals, and 18 miscellaneous reports. The remaining 347 manuscripts were prepared for oral presentation or for publication in technical journals. About 24,000 pages of manuscript were edited and 1,900 illustrations prepared for reproduction. The Senate hearings on the Interior Department appropriation bill were indexed for the tenth year, at the request of the Appropriations Committee.

Training films from the Bureau's free loan library of motion pictures were shown 207,300 times, an increase of 7 percent over the 194,439 showings in the preceding fiscal year. Recorded attendance was 13,088,335, also a new record and up 4 percent from the previous year. In addition, an estimated 43,698,000 persons saw the films over television.

During the year 1,572 new copies of films were added to the loan library, and 1,371 copies were withdrawn from circulation because of obsolescence or wear. The last of the silent films were withdrawn at the close of the fiscal year; the library now is composed solely of 16-millimeter sound films, many of the newer ones in color.

Ten new film subjects were added to the library during the fiscal year: The Making and Refining of Stainless Steel; Oregon and Its

Natural Resources; This Is Magnesium; Sulfur; Powering America's Progress—A Modern Story of Bituminous Coal; California and Its Natural Resources (a revision of an earlier film); The Evolution of the Oil Industry (a revision of an earlier film); Washington and Its Natural Resources; Lead from Mine to Metal; and The Story of Lead.

Like others in the Bureau's loan library, the films added during the year were sponsored by industrial concerns, which defrayed all costs incidental to production and provided the Bureau with copies for distribution to schools, colleges, training classes, the Armed Forces, business and civic groups, and other recognized organizations. No charge is made for the loan of films, but the borrower pays for transportation and for any damage other than ordinary wear and tear.

ADMINISTRATION SUMMARY

Emphasis on improvement of program and administrative functioning was continued.

To improve program guidance and reporting the progress of research and operations projects, a study was made of how these functions were being handled in the other governmental research agencies and in the larger industrial research laboratories. As a result of this study and of the Bureau's particular needs, certain forms were developed, to be used in the field and in the Washington office, for submitting to the Director proposals for new projects or revision of old projects. Forms were also developed for the authorization of projects by the Director. Part 1 of a manual, describing the use of these forms and their flow through the Bureau organization, has been completed. A second part of the manual, describing the methods of making periodic reports of progress on research and operation projects, is in preparation.

Authority has been delegated to regional directors, regions I through VIII, to make appointments and status changes in positions in grades GS–1 through GS–11 and CPC–1 through CPC–10 which have been allocated and established. Some officials in charge of field stations under the jurisdiction of regional directors are authorized to make appointments and status changes in positions GS–1 through GS–7; CPC–1 through CPC–10; and all ungraded positions. Regional directors also have been authorized to allocate positions as following: Regions I, II, III, V, VI, up to and including grades GS–4 and CPC–5; region VII, up to and including grades GS–7 and CPC–9; and regions IV and VIII, up to and including grades GS–11 and all CPC grades.

The Office of the Bureau Safety Engineer continued its work on improving the health and safety of employees. There are five full-time safety engineers and one full-time safety officer in four synthetic-liquid-fuel plants; at each of three other stations, there are designated as safety officers two employees, who carry on these duties as well as performing their regular duties, and one full-time safety officer; at some of the field stations there are safety inspection committees whose chairmen have safety matters directed to them and who make regular reports. In February 1952, all regional directors were requested to designate a qualified person in each station as safety officer to function as such in addition to their regular duties. All Bureau of Mines groups have been requested to take an active interest in Federal Safety Council chapters within their areas. There are 84 of these so far chartered throughout the Federal service.

The injury-frequency rate, which is the number of lost-time injuries per million man-hours of work, was 12.1 for calendar 1951, the lowest of record. The severity rate, which is the number of days lost due to injuries per thousand man-hours of work, was 0.85—43 percent lower than the preceding 5-year average and 39 percent lower than for 1950. These accomplishments are encouraging, since both frequency and severity rates for industry increased, rather than decreased, during calendar year 1951.

In the operation of 1,045 motor vehicles for a total of nearly 6½ million miles, 34 accidents occurred in which Bureau of Mines operators were adjudged to have been at fault in 11 instances, other operators in 13 instances, and blame shared equally in 4 instances. Six persons were injured in these accidents, none seriously, and $1,291.37 in awards for damages was made under the Tort Claims Act. Total known or estimated property damage was: Government, $6,361; other, $2,788.

Four fires occurred in 1951 with a total estimated loss of $51,125, but $51,000 of this occurred out of hours in a building heated by gas and was due to a defective thermostatic control. No blame attaches to Bureau of Mines personnel in this major loss.

On June 30, 1952, there were 4,843 full-time employees in the Bureau of Mines, distributed as follows:

TABLE 1.—Schedule and number of employees

	GS	CPC	Ungraded	Total
Departmental	765	10	1	776
Field	3,023	299	745	4,067
Total	3,788	309	746	4,843

PROPERTY

Property records of the Bureau of Mines, as of June 30, 1952, show accounts as follows:

Automobiles and trucks	$1, 995, 438. 81
Canvas and leather goods	21, 618. 32
Drafting and engineering instruments	110, 129. 16
Electrical equipment	389, 556. 46
Hardware and tools	460, 369. 83
Household equipment	102, 466. 27
Laboratory equipment	5, 719, 077. 11
Medical equipment	38, 670. 95
Office furniture and equipment	2, 113, 456. 48
Photographic apparatus	209, 720. 34
Machinery and power plant equipment	5, 889, 556. 82
Land, buildings, and improvements	24, 777, 006. 49
Specialized equipment and apparatus	12, 112, 898. 59
Total	53, 939, 965. 63

This property is in Washington, D. C., and at the various field stations and offices of the Bureau.

FINANCE

The total funds available to the Bureau of Mines for the fiscal year ended June 30, 1952, including direct appropriations, prior-year balances available, reimbursements, transfers, and advances from other Government agencies, and advances from other than Government agencies, were $44,645,345. Of this amount $36,127,598 was obligated, leaving an unobligated balance of $8,517,747.

Funds available to the Bureau of Mines for fiscal year 1952 (by source of funds)

Direct appropriations	$24, 366, 856
Deduct: Transfer of funds to finance defense activities	44, 000
Net, direct appropriations	24, 322, 856
Prior-year balance available (includes $6,600,000 of contract authorization)	9, 413, 192
Reimbursements from other Government agencies	1, 660, 386
Advances from other than Government agencies	1, 621, 050
Advanced or transferred from other Government agencies	7, 627, 861
Total, Bureau of Mines	44, 645, 345

Obligations incurred by the Bureau of Mines in the fiscal year 1952 by appropriation

Conservation and development of mineral resources:	
1. Fuels:	
(*a*) Coal	$1,984,586
(*b*) Petroleum and natural gas	1,324,300
(*c*) Synthetic liquid fuels	7,609,543
(*d*) Helium	90,112
2. Minerals and metals:	
(*a*) Ferrous metals and alloys	2,136,962
(*b*) Nonferrous metals	2,698,115
(*c*) Nonmetallic minerals	742,076
(*d*) Mineral research, unclassified	613,977
3. Control of fires in inactive coal deposits	356,007
Total, conservation and development of mineral resources	17,555,678
Health and safety:	
1. Investigation of accidents and rescue work	847,542
2. Mine inspections and investigations	2,715,710
3. Explosives and explosions testing and research	500,067
Total, health and safety	4,063,319
Construction:	
1. New laboratory facilities	424,931
2. Drainage tunnel, Leadville, Colo	340,554
3. Synthetic liquid fuels	3,438,247
Total, construction	4,203,732
General administrative expenses	1,257,600
Construction and rehabilitation, Bureau of Reclamation (transfer to Bureau of Mines)	161,854
Helium production	1,131,474
Development and operation of helium properties	573,908
Working fund, Interior, Mines	6,380,010
Administrative expenses, Mutual Security Act, executive (transfer from State to Interior)	45,215
Economic and technical assistance, Asia and Pacific, title III, Mutual Security Act, executive (transfer from State to Interior)	82,476
Economic and technical assistance, Near East and Africa, title II, Mutual Security Act, executive (transfer from State to Interior)	7,232
Contributed funds	665,100
Total obligations incurred	36,127,598
Unobligated balance, June 30, 1952	8,517,747
Total, Bureau of Mines	44,645,345

GEOLOGICAL SURVEY

W. E. Wrather, Director

GEOLOGIC DIVISION

The Geologic Division during fiscal year 1952 continued to place its scientific skills at the disposal of a Nation girding for defense. Survey geologists were called upon to bear much of the responsibility of implementing the Defense Minerals Exploration Administration and the Defense Materials Procurement Agency; to divert personnel for geologic investigations of mineral resources in underdeveloped countries, under the Mutual Security Act; to offer their services as advisers and consultants to the National Security Resources Board, the President's Materials Policy Commission, and the Military Establishment.

Great strides were made in the realm of applied physics and chemistry. New techniques of geochemical prospecting, conceived and perfected by the Survey, have indicated new areas of potential ore bodies by detection of trace elements in soils, waters, and surficial deposits; improved laboratory analytical methods have revealed rare elements occurring within large deposits of commoner economic minerals and constituting valuable byproducts; new geophysical instruments, like the portable scintillation detector used in radiological surveys, have been added to the Survey's ever-increasing array of mineral-detecting devices; unusual geologic environments were explored and studied in the search for oil, such as the subsurface reefs of the Scurry field, Texas; and progress was made in understanding violent terrestial movements like landslides, earthquakes, and volcanic eruptions, and predicting their occurrence.

Although the acute demands of national defense have resulted in some expansion of plant and personnel, they have drawn so heavily upon the existing resources of the Survey that its regular program of work has been retarded. The Survey should be enabled to continue its traditional and carefully planned research and geologic mapping from which have come byproducts that have proved invaluable in times of crises.

Mineral Deposits

Long-term objectives of the Mineral Deposits Branch are (1) to conduct geologic mapping, research, geochemical prospecting, trenching, drilling, and sampling programs relevant to the most effective exploration and development of the Nation's mineral resources, and (2) to maintain a continuing appraisal of these resources.

Field work was carried out on 66 projects in 28 States and Puerto Rico. Exploratory drilling was continued in Iowa, Utah, and Wisconsin. Two geochemical prospecting projects developed field tests for manganese, antimony, barium, and selenium, improved tests for other elements, and made more than 2,000 trace-element determinations a month. Regional mineral resource studies were carried on in the New England-New York area and in the Arkansas, White, and Red River basins. Contributions financed by the Defense Minerals Exploratory Administration and the Defense Materials Procurement Agency, were made to the formulation of a minerals program for the Nation, and for evaluation of applications for loans, preparation of contracts for these loans, and enforcement of these contracts, 260 of which are now in force.

Several important discoveries resulted from field investigations. As a result of geochemical prospecting recommendations, hitherto unknown extensions of the main cobalt-copper-bearing veins in the Blackbird district, Idaho, were found by private industry. A new lead-zinc ore body was discovered in Wisconsin by private exploration based upon the Survey's work in delineating structurally favorable areas. Two potentially valuable phosphate deposits were discovered by Survey geologists in Idaho and Montana. Arkansas bauxite samples that were being analyzed proved to contain about 1 pound of columbium per ton of ore. If these samples are representative it means that the amount of columbium handled during current production of Arkansas bauxite is about as great as the current world production of that metal. A California quicksilver producer revealed discovery of four large ore bodies, based upon Survey-developed principles of structural control of ore in the district.

Two confidential reports on the world resources of tungsten and chromium were submitted to the National Security Resources Board. A titanium bibliography was brought to the manuscript stage and will be submitted for publication shortly. During the year 110 manuscripts were submitted for approval and publication as follows: 1 professional paper, 14 bulletins, 15 circulars, 4 geologic quadrangle maps, 7 mineral investigation maps, 31 reports on open file, 10 reports issued by cooperating States, 27 articles in scientific journals, and 1 chapter to appear in a Bureau of Mines Report of Investigations.

Petroleum and Natural Gas

The Geological Survey aids the search for petroleum and natural gas by providing basic technical data necessary for sound exploration programs. Such information is obtained by systematic geological mapping of exposed sedimentary rock formations and by detailed laboratory study of samples from wells and from outcrops in sedimentary basins that are producing or that may produce oil and gas. Geological Survey reports show the presence or absence of possible source beds or reservoir rocks and provide essential data on other factors that influence the migration and accumulation of oil and gas.

Twenty-seven regional studies were carried on in 18 actual or potential petroleum-bearing States. All these studies were carefully integrated with operations of the oil and gas industry, the State geological surveys, and other agencies. A total of 15 oil and gas maps and charts, 3 circulars, and 2 professional papers providing information on regional geologic problems in 7 western States, and a revised map of the oil and gas fields of the United States were published.

A detailed geologic investigation of the oil-bearing subsurface reef in Scurry County, Tex., was completed for the Petroleum Administration for Defense to supply information concerning the size, shape, porosity, and arrangement of reservoirs in the reef, which will aid in planning the development of the field.

Oil Shale

Investigation of the high-grade oil shale deposits in the Green River formation of Colorado and Utah was carried forward during the year. Detailed mapping and stratigraphic studies of the most promising oil shales in Colorado were completed, reports on two areas within the Piceance Creek Basin were finished, and a final report on the oil shale of northwestern Colorado is in preparation.

Coal

The Geological Survey continued the systematic reappraisal of the coal resources of the Nation, the geologic mapping of economically important coal-bearing areas, and the basic study of the constituents of coal that are necessary for the understanding of the genesis, correlation, and most effective utilization of coal.

Reappraisals of the coal resources of Virginia, Indiana, North Dakota, South Dakota, and Colorado were completed, and circulars on the coal resources of South Dakota and Virginia were published. Detailed geologic mapping of coal fields in Colorado, Indiana, Kentucky, Montana, New Mexico, North Dakota, Ohio, Oklahoma, Pennsylvania, Washington, and Wyoming was continued.

Studies of coal samples at the Coal Geology Laboratory at Columbus, Ohio, yielded important information on the petrography, radioactivity, and paleobotany of coal, which is of help in solving problems relating to the correlation and genesis of coal beds. Basic data needed for deciding upon the most effective utilization of various coals as fuel, as a source of synthetic liquid fuels, and as a raw material for chemical processes, have been gained as a result of the field and laboratory work carried on during the year.

Engineering Geology

The geologic mapping for general service and engineering purposes was continued in the fiscal year, and five new projects were begun in areas where major engineering works are planned. By detailed mapping of bedrock and surficial formations the geologist obtains the answers to many of the questions that confront the engineer during the planning stages, such as depth to rock, sources of construction materials, stability of landslides, mineral evaluation in relation to land appraisal, and foundation conditions at sites of proposed highways, bridges, overpasses, large buildings, and other structures.

Four projects were added to the program of mapping urban and industrial areas. These are Denver, Colo.; Los Angeles, Calif.; Seattle, Wash.; and Omaha, Nebr. Work was continued in Knoxville, Tenn.; San Francisco, Calif.; Great Falls, Mont.; and Portland, Oreg. New undertakings include detailed geologic mapping on the upper Green River, Utah, to supply data for a new regional land development and power project; and a study of the landslides at the Fort Randall Reservoir in South Dakota.

Almost one-third of this program is in the Missouri River basin in support of the Department's program for basin development. A geologic mapping program in Massachusetts and Rhode Island is being carried on in cooperation with those States.

In all, 17 field projects were in progress in 10 States. Fifty-six reports were made available to the public through open files in Washington, D. C., and Denver, Colo.; 6 reports were published by the Survey; and 14 reports were published by professional journals. Twelve foreign engineering geologic works were translated and placed on open file, and more than 100 other foreign works were abstracted.

General Geology

The technical advances that support our increasingly high standard of living are to a great degree the byproducts of scientific research, carried on for its own sake, and with no specific objectives other than the desire to learn fundamental truths about natural phenomena. In the field of geology pure research has contributed to the discovery of many valuable mineral deposits. Therefore, although much of the Geological Survey's field work is directed toward the appraisal of known mineral deposits and toward the search for new deposits, part of the effort is devoted to systematic geologic mapping and research. This concerns several fields of geology, and for convenience they are identified as general geology.

A good example of the direct economic benefits of pure research is shown by results obtained in California. For several years the Mojave Desert has been the site of a general mapping and research project. Two years ago this work led to the discovery of deposits of hitherto little known cerium minerals and has since provided the background of information that was necessary to guide the exploration of these deposits to the end that large reserves of cerium have been established. The project has also been instrumental in the discovery of deposits of valuable mineral salts. As a result, emphasis in this particular project has changed from general research to economic geology.

Field activities in general geology included 19 projects in 15 States, the Aleutians, and the Territory of Hawaii. The projects in Hawaii and the Aleutian Islands are concerned chiefly with the study of volcanic processes, but also embrace strategic terrain studies for the armed services. Other general geologic projects involved research in tectonics, glacial geology and geomorphology, the mechanics of igneous intrusion, and rates of sedimentation.

Geophysics

Airborne magnetic or radiometric surveys were made in 12 Northeastern and Western States. Compilation of data for 40,000 traverse miles was completed, 28 maps were released to open files, and 32 maps were published. With the release in January of maps of 12 counties, Indiana became the first State to be completely mapped aeromagnetically. The aeromagnetic anomaly of greatest intensity yet observed, 1,200 gammas at 10,000 feet, was mapped over the Sacramento Valley. Flights over the Duluth gabbro, in which a copper-nickel ore discovery has been reported, also recorded anomalies of great intensity. Airborne radioactivity surveying has been developed to the stage of routine application and is proving a useful tool for uranium prospecting.

Ground surveys were made in 11 States, in Alaska, and in two areas outside North America to determine depths to bedrock, locate aquifers, study buried valley systems, and provide structural or stratigraphic information for investigations of mineral deposits.

Geothermal investigations in Arctic regions were continued. Data thus far accumulated have provided important scientific and engineering information on thickness and temperatures of permafrost, effects of building heat on the cold reserve beneath buildings, and the time required for drill holes to reach thermal equilibrium.

Seismic observations in the Aleutians were continued. Interesting correlations have been indicated between volcanic activity and the frequency of earthquakes near Adak and Great Sitkin. A memoir on the interpretation of aeromagnetic maps was published. Abstracts of current geophysical literature were prepared and published in the quarterly Geophysical Abstracts.

Geochemistry and Petrology

The determination of the chemical and mineralogical composition and structure of rocks, ores, and minerals is a vital part of the Geological Survey's program of geologic mapping and mineral resources investigations. Special skills in mineralogy, petrology, chemistry, and physics, and elaborate laboratory facilities are required to supply this analytical service. This service, performed in the field and in the laboratory, is one of the major functions of the Branch of Geochemistry and Petrology. Other functions include aid to the geologists and cooperation, oftentimes in the field, in making interpretations requiring a knowledge of the physical and chemical properties of rocks and minerals, their relationships, modes of origin, and reactions. Research on specific problems in the field of geochemistry is also carried on, and continued efforts are made to improve analytical methods. In the past year 28 papers and reports resulted from these activities.

Considerable progress was made in the search for possible new sources of columbium. As a result of many laboratory analyses, the possibility is indicated of utilizing waste materials from bauxite and titanium metal plants as a source of this critically needed element.

Basic research was begun on the geology and geochemistry of uranium in the following studies: Distribution of uranium in igneous rocks, synthesis of uranium-bearing minerals, X-ray diffraction studies, and isotope geology of uranium, thorium, and their decay products.

Paleontology and Stratigraphy

Data and conceptions essential to the solution of problems in applied geology are provided by research in the succession and relationships of life and sedimentary rocks throughout time. Specialists of the Paleontology and Stratigraphy Branch determine the age, ecologic implications, and biologic affinities of fossils referred for study; help other Federal geologists with field problems in stratigraphy; and engage in planned original research.

An effort was begun to establish criteria for the zonation and correlation of oil-producing strata in the Williston Basin of the northern Great Plains. Aid in determining the precise age, depositional conditions, derivation, and correlation of uranium-bearing rocks was increased. Assistance in the distinction, correlation, and interpretation of rock units in areas of military importance was intensified. Additional assistance was given to correlation studies relating to Alaskan naval oil reserves. Preparation of 334 reports on referred collections involved study of more than 42,000 specimens from 29 States and 17 foreign countries. Published research by a member of the branch, done in cooperation with the Tennessee Division of Geology, was credited with major discoveries of domestic zinc ore.

Forty-five reports of investigation were approved for publication and thirty-seven were published. Cooperative studies of the geology and paleontology of Bikini were completed. Professional Paper 206 was reprinted because of requests of oil geologists.

Geologic Investigations in Alaska

Continuing international uncertainty has again affected the balance of the Geological Survey's program of geologic investigations in Alaska. Private and Government activities in the Territory continue to revolve in large part around the requirements of the National Military Establishment. This has meant increased activity in the Geological Survey's search for and examination of local sources of construction materials; and in advising Territorial and military officials on the selection of transportation routes, air fields, and building sites. Meantime, interest has increased in the fuel reserves of the Territory and in the potentialities of its strategic and critical minerals.

Specific investigations included studies of construction materials in areas adjacent to the main railroad and highway system, marl and shale deposits in the Matanuska Valley, tin deposits on the Seward Peninsula, tungsten deposits in the Fairbanks district, antimony deposits in the Sawtooth Mountains near Livengood, copper deposits in the Prince William Sound area, and detailed and reconnaissance mapping of mineralized areas in southwestern and southeastern

Alaska. Coal investigations were conducted in the Matanuska, Nenana, and Kenai coal fields, and a preliminary office study was made of the Bering River coal fields. Geologic studies were also continued in the Chinitna-Tuxedni area and in the Yakataga and Katalla areas. A preliminary report on the Katalla field was released for public use late in the fiscal year. In northern Alaska petroleum investigations were continued as in past years, largely financed by Navy funds.

Military Geology

The Geological Survey continued operations in military geology at the behest of the National Military Establishment. Information was supplied on the geology, soils, terrain, water supply, and construction problems of many areas. As in former years, most military projects were financed by the Corps of Engineers under a cooperative agreement.

A special cooperative agreement between the Survey and the Corps of Engineers made possible a reconnaissance survey of little-known islands in the northern Marshalls. This study yielded much basic scientific information on the deposits and structures of atolls, their water supply, and vegetation pattern. Studies are now in progress on two other significant islands.

A group, utilizing the Geological Survey library and other research libraries in the vicinity, collected and interpreted basic data on foreign areas. Many reports, mostly at a strategic level, were finished during the year.

The field programs in the western Pacific are continuing. Detailed geologic and water-resources mapping of Guam is in progress and a soils survey is soon to begin. Plans have been made to undertake mapping of those islands of the United States Trust Territories of the Pacific that have not already been mapped. In Alaska selected areas are being studied with special reference to arctic and subarctic terrain, permafrost, and vegetational conditions.

Military geology reports covering Alaskan and Pacific island areas, Fort Benning, Ga., and the Sixth Army area are now in preparation.

Foreign Geology Investigations

The Geological Survey's activities in foreign geology, which began in 1940, increased in scope and tempo under the Mutual Security Act of 1951. The long-range programs of geologic investigations of metallic deposits continued in Mexico, Brazil, and Peru; nickel investigations were resumed in Cuba; reconnaissance investigations preparatory to advising on mineral exploration programs were initiated in Paraguay and Chile.

Ground-water and minerals investigations in Saudi Arabia and India have resulted in discovery of water to relieve critical shortages in several key municipalities; 6 million tons of manganese have been proved in India. Fuels investigations in Thailand resulted in the discovery of 10 million tons of coal where coal reserves were heretofore thought to be insignificant. A published report on the Philippine sedimentary basins led to renewed and increased interest on the part of major oil companies to undertake oil exploration. Significant areas of potential manganese deposits were mapped in the central islands of the Philippines.

Cooperative geologic investigations with British Colonies, begun in fiscal year 1950 under the Mutual Security Act, were concluded. This activity set in motion long-range country-wide minerals investigative programs which are now being carried forward by the staffs of the various British colonial geological surveys.

The Geological Survey has assigned 27 foreign trainees to its domestic field parties and has arranged for them to obtain specialized academic training. Leaders and specialists from countries getting mutual security aid received 3-month scientific, technical, and administrative orientation grants at the Geological Survey in Washington and at its domestic field offices and projects.

The branch published three bulletins in the year. One, the report of a geologic reconnaissance of Thailand, is being republished by the Thai Bureau of Mines in the native language.

Geologic Maps

The Office of Geologic Cartography, in conjunction with the 6 field units, prepared 1,229 geologic maps, charts, diagrams, and other illustrations for multicolor and black-and-white reproduction. Final copy for 6 maps in the geologic quadrangle series, 7 mineral investigations maps, 32 fuels maps, 23 geophysics maps, and 9 State index maps were transmitted to the Branch of Map Reproduction. Fifty-five other multicolor maps are in various stages of preparation.

The geologic map editor reviewed and edited 2,860 maps and figures, involving 361 reports. About 80 percent of these illustrations were designated for publication by the Survey; the rest were routed for publication by cooperating State and Federal agencies or by scientific journals.

Library

In volume of material received, number of items loaned, and number of people using its faciilties, the library had the busiest year of its history.

Almost 24,000 books, maps, and serial parts were added to the collection of the Washington library. More than 26,000 items were loaned to Survey personnel for use outside the library, and 4,000 to other libraries. More than 20,000 readers, including about 4,000 non-Survey readers, used the library's facilities.

The branch libraries at Denver and San Francisco have been enlarged considerably during the year, both in their collections and in additions to personnel. The staff at the Denver library has been increased to seven, and the San Francisco library acquired a librarian at the beginning of the fiscal year.

The Bibliography of North American Geology for 1950 is in press. It is annotated for the first time since World War I. However, lack of staff has compelled the abandonment of annotations to permit work on the cumulative bibliography for 1940–49. A copy of the library's catalog, for use as a reference by the Denver branch, is almost completed.

TOPOGRAPHIC DIVISION

The Topographic Division has the duty of meeting the Geological Survey's responsibility to prepare a topographic record of the physical and geographical features of our country. This duty is being fulfilled by preparing, maintaining, and distributing topographic quadrangle maps which will eventually cover the entire United States on a scale of 1:62,500. To supplement this topographic atlas, the Division is also doing 1:24,000-scale topographic mapping of critical and economically important areas throughout the United States, its Territories, and possessions. In line with these duties, the Division is called on to meet, dollar for dollar, any cooperative mapping allotments made by the various States. In fiscal year 1952, 29 States and Puerto Rico contributed to cooperative mapping programs of this kind. Mapping or map revision of some kind was carried on in all the 48 States and in the District of Columbia, Alaska, Puerto Rico, and the Hawaiian Islands.

The Federal mapping program was again directed toward strengthening national defense, and a large part of the productive capacity of the Division was utilized to meet the immediate needs of the Department of Defense. Work on its 6-year plan for mapping of strategic areas, begun by the Division in fiscal year 1951 and paid for by funds transferred from the Corps of Engineers, was reoriented in keeping with certain changes in priority established by the Department of Defense and was continued. Earlier completion dates were set for the mapping of certain areas, although the entire program is still scheduled to be completed June 30, 1957. To meet the earlier deadlines, personnel were diverted from projects begun in other areas before the 6-year program was undertaken, additional personnel were employed, and contracts covering separate operations of mapping were awarded.

Map-making facilities in the regional offices were expanded to meet demands for increased productions. New air-conditioned buildings, especially designed to meet the requirements of mapping operations, were constructed for three regional offices, the Atlantic in Arlington, Va.; the Central in Rolla, Mo.; and the Pacific in Sacramento, Calif. Additional air-conditioned space was also provided for the Rocky Mountain Region at Denver Federal Center, Denver, Colo. Double-shift operations were more fully applied in all photo-mapping units, and there was considerable overtime work in nearly all office operations as a means of increasing productive capacity.

In order to meet the immediate demands of a largely expanded defense mapping program, contracts were placed for the performance of separate operations involved in the mapping of areas aggregating 16,000 square miles, at a total cost of $1,500,000. Because this was a departure from usual Survey operations, it required writing detailed specifications of the work to be performed, and establishing procedures for inspecting and testing the completed work for compliance with prescribed standards.

Technical assistance, as required, was offered to the nations of the free world in the forms of training of photogrammetrists and topographic engineers, specifications for aerial photography and map compilation, advice on contractual mapping, and supervision, inspection, and testing of map compilation. The Division cooperates in these endeavors with the Technical Cooperation Administration of the Department of State and the Mutual Security Agency. Also, the Division cooperates with the Pan American Institute of Geography and History through conferences on standards and techniques, and with the Inter-American Geodetic Survey by accepting advice on the capabilities of men for training and by doing its part to further the aims of the organization for better maps and control for South and Central America.

Mapping Programs and Map Production

Federal-State cooperative programs, whereby mapping costs are shared equally between a State and the Federal Government, were conducted in the 29 States of—

Arkansas
California
Colorado
Connecticut
Georgia
Illinois
Indiana
Iowa
Kansas
Kentucky
Louisiana
Maine
Massachusetts
Michigan
Minnesota
Missouri
New York
Nevada
North Carolina
North Dakota
Ohio
Oklahoma
Pennsylvania
Tennessee
Utah
Vermont
Virginia
Washington
Wisconsin
and in Puerto Rico.

The new cooperators in the list are Colorado, Georgia, Nevada, and Oklahoma. The Survey also continued to give financial assistance to the Tennessee Valley Authority in completing the topographic mapping of the valley. This work has no relation to the Tennessee State cooperative program which includes only those areas outside of the Tennessee River basin. The cooperative program in Kentucky, the largest one in the history of the Survey, reached about 30 percent of completion, approximately in line with the goal of completing the mapping of that State in 5 years.

Because of the high priority of defense mapping, it was not always possible to select areas for Federal mapping on the basis of requests submitted by the principal map-using agencies. However, the procedures set up by the Bureau of the Budget for this purpose were used, and priorities for new mapping projects were determined even though the beginning of work on most of these projects would have to await an increase in productive capacity beyond the needs for defense mapping. A start was made toward developing a better procedure whereby State agencies could express their needs for Federal mapping through a single coordinated request from each State. Several States have already organized for this purpose mapping advisory committees on which are represented the major map-using groups wholly within the State.

Topographic mapping operations were continued in the Missouri River basin, although it was necessary to reduce activity by about one-third because of a reduction in the funds appropriated for that work.

The Special Map Projects Section was engaged in the compilation and preparation for publication of State, sectional, and regional maps on scales of 1:250,000; 1:500,000; and 1:1,000,000. Limited work on the United States portion of the International Map of the World on a scale of 1:1,000,000 was continued. Sheets I–11 (Los

Angeles) and I–17 (Savannah) are ready for publication, although the preparation of new maps in this series, including two already begun—J–17 (Blue Ridge) and H–17 (St. Augustine)—has been suspended.

Publication and distribution of a civil edition of the 1:250,000-scale maps compiled by the Army Map Service were continued. This is a provisional series prepared by the Department of Defense for military purposes and is not intended to show accuracy of detail. However, the publication of a civil edition will provide reconnaissance topographic maps of many areas for which no topographic information of any kind is at present available.

Progress on the Transportation Maps of the United States for the Bureau of Public Roads was continued only until July 23, 1951, when the task was transferred to the Coast and Geodetic Survey of the Department of Commerce.

In the new series of State maps on the scale of 1:500,000, compilation was completed for maps of Illinois, Missouri, Oklahoma, and Ohio, and the manuscripts were transmitted for reproduction. Maps for the States of New Mexico, New York, Oregon, Pennsylvania, and Tennessee are in various stages of compilation and inking. The map of California is being prepared for publication on the 1:500,000 scale. A new base-map edition and one carrying contours and highways, covering the two States of New Hampshire and Vermont, were published.

A new topographic map of Puerto Rico and adjacent islands on a scale of 1:120,000 was published, and another covering the same area on a scale of 1:240,000 is now in the process of reproduction. The latter will be published in a shaded-relief issue, as well as in the regular form.

The Trimetrogon Section continued its work of preparing special maps and aeronautical charts for the United States Air Force. In general, these assignments provide for the cartographic or photogrammetric compilation or revision of base charts preliminary to photolithographic reproduction. This work forms an integral part of the over-all program of the Air Force for the production and maintenance of adequate world-wide coverage of aeronautical charts, primarily in the interest of national defense.

About 400 charts were prepared, covering 376,000 square miles. These include 223,000 square miles of entirely new photo compilation and 153,000 square miles of revision and cartographic compilation. Various special projects were involved covering areas in practically every part of the world.

The Trimetrogon Section also continued special mapping work for other Federal agencies and investigated new approaches to some of the normal operations of the Division. A new application of the slotted-templet method is being used in a test compilation of 55 7½-minute quadrangles in Louisiana. It is hoped that the test will prove the usefulness of the method and release stereographic equipment for contouring. The mapping of a test area in Nevada involving the use of 9-lens, P–K photographhw has been completed and the results have been sent to the field for field completion which includes examination and verification, as well as completion by field methods of mapping operations that cannot be done in the office from the aerial photographs.

Mapping in Alaska was continued and an area of about 16,400 square miles was covered at a scale of 1:63,360. Compilation work on the provisional issue of 1:250,000-scale maps is almost completed. Already maps of 92 of the 153 quadrangles have been published, and all except 14 of the others have been completed and will soon be ready for publication. The few sheets remaining unfinished are mostly in southeast Alaska and in the Aleutian Islands.

In continental United States (excluding Alaska) 69,500 square miles of topographic mapping was completed during the year. This figure includes 9,700 square miles of map revision.

Horizontal control was established over an area covering 71,100 square miles (including 18,900 square miles by triangulation and 14,235 linear miles of transit traverse). Vertical control covered 55,900 square miles (16,060 linear miles of leveling) and supplemental control 44,700 square miles.

In the compilation phases of mapping, 63,000 square miles were completed by stereo-compilation methods, consisting of 24,800 square miles of planimetric bases and 38,200 square miles of combined bases and contouring. Field compilation accomplished during the year consisted of 39,200 square miles of field completion, 21,200 square miles of plane table mapping, and 10,200 square miles of revision—a total of 71,000 square miles. The totals for stereo and field compilation are not additive because most stereo-compilation, at some time, must pass through one of the phases of field compilation—either plane-table mapping in the case of planimetric bases, or field completion of areas contoured by stereographic methods. The division drafted and prepared for reproduction maps of 73,500 square miles. Relief shading was completed on 23 maps.

Topographic maps forwarded for reproduction totaled 930, including 4 to be engraved. Of these, 625 were 7½-minute quadrangles and 200 were of the 15-minute series. In addition, the Division prepared reprint editions of 198 quadrangle maps, 14 State base maps, and 24 State index maps. At the close of the fiscal year 464 maps were in process of reproduction, including 46 reprints. During the year 765 new quadrangle maps and 189 reprints were published. About 20 percent of the new maps resulted from original mapping done by the Tennessee Valley Authority, the Coast and Geodetic Survey, the Army Map Service, and the Forest Service. In keeping with present policies, the topographic map material produced by these agencies is published and distributed to the general public by the Geological Survey.

A detailed summary of production, covering new mapping, remapping, and revision is shown on the following table.

Areas (in square miles) mapped during fiscal year 1952 for publication on standard scales

[Contour intervals, 5 to 100 feet]

State	Area mapped, scale			New mapping	Revised mapping	Total
	1:24,000	1:31,680	1:62,500			
Alabama						
Arizona	187			187		187
Arkansas	961			961		961
California	4, 986		9, 477	10, 290	4, 173	14, 463
Colorado	964			964		964
Connecticut		276		52	224	276
Delaware	40			40		40
District of Columbia						
Florida	2, 018			2, 018		2, 018
Georgia	31			31		31
Idaho	547		414	961		961
Illinois			1, 430	1, 273	157	1, 430
Indiana	958			901	57	958
Iowa			840	840		840
Kansas	549			549		549
Kentucky	5, 804			5, 804		5, 804
Louisiana	368		580	580	368	948
Maine			1, 265	468	797	1, 265
Maryland	37			37		37
Massachusetts		484			484	484
Michigan	555		184	245	494	739
Minnesota	997		1, 252	2, 226	23	2, 249
Mississippi						
Missouri	1, 043			1, 043		1, 043
Montana	1, 274		72	1, 346		1, 346
Nebraska	1, 513			1, 463	50	1, 513
Nevada			3, 594	3, 594		3, 594
New Hampshire						
New Jersey	12			12		12
New Mexico	2, 286		761	2, 536	511	3, 047
New York	1, 149			880	269	1, 149
North Carolina	79			79		79
North Dakota	1, 318		314	1, 632		1, 632
Ohio	960			522	438	960
Oklahoma	60			60		60
Oregon	78		1, 315	1, 389	4	1, 393
Pennsylvania	481			481		481
Rhode Island						
South Carolina						
South Dakota	2, 814		283	2, 814	283	3, 097
Tennessee	1, 184			1, 184		1, 184
Texas	4, 224		763	4, 987		4, 987
Utah	652		872	1, 524		1, 524
Vermont			468	43	425	468
Virginia	30		359	359	30	389
Washington	183		1, 043	382	844	1, 226
West Virginia	39		27	66		66
Wisconsin	163		900	955	108	1, 063
Wyoming	4, 011			4, 011		4, 011
Total	42, 555	760	26, 213	59, 789	9, 739	69, 528
Alaska			[1] 16, 419	[2] 53, 289		[2] 53, 389
Puerto Rico		[3] 905			905	905

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[1] Mapped on a scale of 1:63,360.

[2] Includes 36,870 square miles mapped on a scale of 1:250,000, not listed in the columns under "Scale."

[3] Mapped on a scale of 1:30,000.

Research and Development

Progress has continued in the preparation of the Topographic Manual. To date 19 chapters have been published, 50 additional chapters are in advanced stages of preparation, and material for 20 other chapters is in preliminary form. The instructions on multiplex procedure, composed of five separate chapters, were published and widely distributed both in the Geological Survey and in other organizations, public and private.

During the year all relevant information pertaining to the classification of topographic maps distributed by the Geological Survey was placed on machine tabulation record cards and now it is possible quickly to segregate maps of various related characteristics whenever needed for management purposes.

Persistent efforts were continued to find more efficient methods to establish geodetic control. Electronic methods are promising, and research to adapt them to mapping purposes was given considerable attention. The results of mapping, based for elevation upon vertical radar measurements from an airplane carrying a sensitive barometric altimeter, and for position upon shoran, were tested carefully and were found to be encouraging.

A new self-leveling level instrument was tested and adopted, to speed the field work of determining elevations. Other innovations for increasing efficiency of field operations included the adoption and procurement of new induction-damped lensatic compasses for traverse parties, and mechanized post-hole diggers for setting survey monuments.

Researches and experimental tests were conducted on the development of a mechanical traverse meter. Electronic surveying equipment was used experimentally on an operational project in the Kings River area of California for the measurement of distances for vertical-angle elevation determination.

During the year, a small amount of horizontal and vertical control was extended concurrently by subtense base triangulation and simultaneous reciprocal vertical angles. The operations were coordinated by two-way radio. The method has proved to be a practical means of reducing over-all control costs when used over favorable terrain.

A study was made of the problem of observing Polaris for the determination of azimuth. Such observations were usually taken at night except under favorable daylight conditions. As the result of this investigation, improvements have been made in technique and equipment which make it practicable to take daylight observations under conditions that formerly would have been considered unfavorable.

A heat-pressure process for laminating drafting paper onto aluminum sheets was developed. It improved the quality of the drafting surface. In addition the use of thinner, stronger aluminum gave the laminated sheets greater durability and greatly reduced the quantity of aluminum required.

A vacuum-back copy board for large process-cameras used in map reproduction was developed to provide more positive camera adjustment with correspondingly less distortion of the negatives produced, and to provide convenient means of adjusting or changing copy. It is expected that the copy board will improve the quality of the negatives and increase laboratory production.

A portable reflecting projector was developed primarily for field-office use in transferring information from aerial photographs onto map manuscripts. The projectors are especially useful for revision projects and for the transfer of such additional detail from aerial photographs as is found necessary during field inspection of photo-compiled maps.

A study of optical-reading telescopic alidades was made, and development of a new pendulum-type, self-leveling, optical-reading alidade is in progress. Both the optical-reading and the auto-leveling features are expected to improve the speed with which alidades can be used.

Particular attention is still being given to photogrammetry, and the further development and application of the advantages available in this important field. In accordance with long-range plans, contracts were awarded for additional multiplex equipment, Kelsh plotters, and universal plotters, in sufficient quantity to increase the existing stereoplotting capacity of the Division by 39 percent.

An important step toward the improvement of the quality of aerial photography was taken with the award of contracts for 10 aerial cameras of a new and highly improved type. These new cameras, designated T–11, will be equipped with Planigon lenses that are nearly free from distortion.

Substantial progress was made in the construction of a multi-collimator camera calibrator, parts for a special photogrammetric optical bench, and a measuring comparator, all of which were contracted for in fiscal year 1951. Delivery of these instruments in fiscal year 1953 will constitute another important step in the improvement of aerial photography, for they will provide major equipment for testing and calibrating precision photogrammetric cameras in the Geological Survey's own optical laboratory.

Several major research projects, directed toward the development of new photogrammetric equipment, techniques, and procedures, were continued. One of these projects, undertaken cooperatively with the

Air Force, calls for the development of an improved twinplex stereoplotting instrument and auxiliary equipment. Another involves the development of an ellipsoidal-reflector projector for stereoplotting; several critical phases of this undertaking have been successfully completed, and it is expected that the prototype instrument will be put into operation in fiscal year 1953. Plans were also completed for the construction of diapositive printers of completely new design using aspheric correction plates.

In addition to the work on new instruments, research on the performance characteristics of the Kelsh plotter was continued and several design changes were developed. Also, a statistical study of accuracy tests of completed maps was conducted with the purpose of gathering technical information for use in planning photogrammetric mapping projects. These, along with several smallar projects, were undertaken in line with a continuing effort to improve the details of photogrammetric operations.

Work on map design and the improvement of drafting equipment and map-finishing procedures continued to be important. Printed maps were regularly inspected for factual content, legibility, and general appearance to determine where improvements might be made.

Symbol standardization was reviewed with other Government mapping agencies, and many changes were adopted. A survey of recent accomplishments and current activities in cartographic research and development was completed. This survey provides information of value to all cartographers and, it is hoped, will eliminate much duplication of effort in this field.

Map Information Office

The large volume of requests for the data that are available through the Map Information Office made the year the most active in the history of the Office. These requests have been widespread in both origin and nature. They came from Federal and State agencies, geologists, geophysical-prospectors, and aerial mapping firms, from highway and railway engineers, from engineers and technicians concerned with the construction of water-supply facilities, public utility projects, industrial plans, and various conservation programs. In all, the Office serviced 35,000 requests, an increase of 5,000 over the preceding year. More than 9,000 visitors used the facilities of the Office.

The usefulness of preliminary map material, made available in advance of final publication, is evident by the volume of requests for this type of data. In conjunction with the regional offices, 39,514 advance prints of maps were supplied. A large number of requests for horizontal and vertical control were received from commercial firms for use on microwave transmission systems along pipelines, in guided-missile research, for radio and television station development, and for other purposes.

The requests for aerial photographic reproductions continued, particularly for areas in which topographic maps are either obsolete or not yet available. Altogether, 88,402 reproductions were supplied.

The third edition of the index maps showing the status of topographic mapping in the United States was published. These index maps classify topographic and planimetric maps published by the Geological Survey and other Federal agencies, thereby providing map users with current information on the quality of topographic map coverage and the new mapping in progress. The second edition of index maps showing horizontal control and vertical control in the United States, and the second edition of an index map showing the status of aerial mosaics in the United States were published.

WATER RESOURCES DIVISION

The Nation's water supplies are being used at a progressively accelerated rate because of our mobilization for defense, our expanding industry and population, and technological advancements. Industrial water demands, according to the President's Materials Policy Commission, will increase about 170 percent in the 25-year period between 1950 and 1975. In 1950 the American people had more than $50 billion invested in all types of water-management structures and facilities. To develop and manage efficiently the full potential of our water resources, we must record significant information about their ceaseless changes. The unbiased collection, compilation, and interpretation of this information is the work of the Water Resources Division which by publication and counseling makes its records available to governmental units and the public.

In fiscal year 1952 more than one-quarter of the funds available for water-resources investigations was transferred from other Federal agencies for specific work done for them, one-quarter was provided by States and municipalities for cooperative (dollar-for-dollar) investigations, and nearly one-half were directly appropriated. The 1952 program was about 10 percent greater than that for 1951.

Contractual investigations were made and paid for by funds supplied by about 15 Federal agencies including the Department of Defense, Bureau of Reclamation, Bureau of Indian Affairs, Bonneville Power Administration, Department of State, Atomic Energy Commission, Tennessee Valley Authority, and the Federal Power Commission.

Funds made available by the States and matched by the Division for cooperative studies were:

State:	*Obligations*
Alabama	$94,062
Arizona	94,800
Arkansas	50,868
California	223,700
Colorado	38,500
Connecticut	18,400
Delaware	18,407
Florida	130,825
Georgia	46,500
Idaho	55,508
Illinois	57,700
Indiana	83,540
Iowa	82,025
Kansas	59,700
Kentucky	109,700
Louisiana	57,500
Maine	10,000
Maryland	74,937
Massachusetts	35,725
Michigan	93,438
Minnesota	30,790
Mississippi	19,000
Missouri	23,307
Montana	28,850
Nebraska	60,000
Nevada	24,929
New Hampshire	$11,729
New Jersey	55,200
New Mexico	98,195
New York	214,604
North Carolina	57,430
North Dakota	32,812
Ohio	147,900
Oklahoma	74,600
Oregon	57,575
Pennsylvania	127,225
Rhode Island	7,900
South Carolina	25,395
South Dakota	7,000
Tennessee	63,707
Texas	194,200
Utah	97,500
Vermont	7,760
Virginia	63,100
Washington	103,655
West Virginia	21,740
Wisconsin	31,850
Wyoming	45,110
Hawaii	81,219
Total	3,250,117

The Division's Surface Water, Ground Water, and Quality of Water Branches and their 120 principal field offices, working individually and in combinations, are concerned with specialized studies of the maximum development and best use of our water resources which are necessary for the existence of man and the pursuit of all his activities.

Information about our water resources is made available principally through publications designed to supply data for their most satisfactory development and use. A measure of the use of these data is indicated by the 13,300 specific requests for data which the Division received in 1952. The sources of these requests are: Other Federal agencies, 4,500; State agencies, 1,600; cities, counties, and water districts, 1,400; industrial and commercial firms, 3,800; individuals, 2,000.

The applications to be made of the data requested and the data available through regular publications are indicated in the following specific accomplishments for fiscal year 1952.

Municipal Water Supply

An increasing and shifting population and higher per capita consumption of water have so increased the demands on some municipal, or public, water supplies that a critical point has been reached if the supply is to be maintained at a satisfactory quality and furnished at a rate the consumer can afford to pay. To provide and interpret data that the engineer will use in locating, designing, and equipping public water-supply systems costing millions of dollars is one aspect of the coordinated work of the Surface Water, Ground Water, and Quality of Water Branches.

In 1952 the Division published reports summarizing and evaluating all available water-resources data on municipal and industrial supply, pollution control, and flood protection for five large industrial centers, and investigations were in progress for six other areas. Data about the chemical characteristics of the larger municipal water supplies throughout the country are being assembled. Reports on three large areas in the United States were completed during the year.

In addition to the information disseminated by publications, the Division answered 800 requests by public water suppliers for data on water resources.

Industrial Water Supply

Industrial water supply is used here to mean water drawn directly from streams, wells, lakes, and reservoirs, and water taken from the public supply by industry.

Our expanding industry, its pace now accelerated by the mobilization for defense, is requiring greater supplies of water at its present sites, adequate supplies at new sites that are being chosen, and waters to meet new and very strict requirements brought about by technological changes. Also, certain marginal industrial firms can operate only if they have inexpensive water supplies of very special chemical qualities. These and other firms make use of data collected by the Division. Plants manufacturing synthetic fibers and antibiotics, like penicillin, and other new drugs require great quantities of high-quality water; some other industries are needing larger volumes of water, generally ground water of as low a temperature as is available, for cooling purposes; and the growing use of air-conditioning equipment in industry, commerce, and homes requires large quantities of water.

The Division has undertaken to collect data on the minimum requirements of many industrial users and, in places, the necessity of conserving the supply by reuse. Some information was obtained on the water needs of the pulp, paper, rayon, petroleum, carbon black, copper, and aluminum industries; and among significant facts learned is that within certain industries one manufacturer may use several times more water than another in exactly the same operation.

Mining hydrology studies in east Tennessee resulted in the solution of a water-inflow problem that had prevented mining of an important zinc deposit. Similar problems are now being solved for the mining industry in Michigan, Minnesota, and Arkansas, and others in Alabama (iron) and Wisconsin (lead-zinc) have been proposed for study.

In 1952 the Division received 700 requests for information predominately for potential and actual industrial uses. Data showing the percent of time that streamflow at any one place could be expected to equal or exceed a given quantity assisted in the location of plants that would have a sufficient water supply for year-round operation.

Flood-Control and Hydroelectric-Power Dams, Flood Forecasting, and Navigation

Records of streamflow are made at roughly 6,400 gaging stations in the 48 States and in Alaska and Hawaii, and these are published in the annual series of water-supply papers entitled "Surface Water Supply of the United States." The dissemination of these records, together with the answering of 3,500 specific requests in 1952, provided the key to countless governmental and private activities. These activities, which will be discussed in part under irrigation and pollution control, include these applications of data, among a multitude of others:

The location of highways, railways, and bridges is determined in part by records of streamflow, perferably over a long period of years. For example, the records might indicate that it would be more economical to construct a bridge that might be washed out once every 20 years and that could be replaced at relatively little cost, than to spend many times the replacement cost in locating the bridge out of flood reach. Measurements of streamflow are necessary, too, in determining the size of bridge openings and the spacing and construction of piers.

Streamflow data are a prerequisite to the location, design, and operation of hydroelectric-power and flood-control dams, and levees. If a dam is underdesigned it may not fulfill its purpose, if it is overdesigned it may be washed out. The design of reservoirs and spillways is based on records of stream discharge, and their operation is determined by interpretations of water records that have been diligently and unspectacularly kept day by day for many years.

The location of flood-control dams, and hydroelectric-power dams as well, depends too on records of sedimentation that are collected and interpreted by the Division. If sedimentation were to make a dam useless in too brief a period, it would be uneconomical to build it.

Records of streamflow are used in the forecasting of flood crests in all parts of the Nation whenever floods threaten. In addition to the uses governmental and company hydrologists and engineers made of publicly circulated data, the Division received 1,000 specific requests for information about flood forecasting.

Irrigation

Twenty-three hundred specific requests for information relating to irrigation were received by the Division in 1952, in addition to the widespread consultation of the regularly disseminated records of the three Branches by planners of irrigation projects. Even the cotton-patch farmer must know that the water he pumps is not so contaminated that it will kill his crop. Any planned irrigation project is dependent not only upon the available supply of surface and ground waters, but upon their chemical qualities, and, in places, upon drainage problems involved. Thus our continuous need for an increased food supply can be met in part only by a complete knowledge of our present and potential water resources and their conservation.

A preliminary report was prepared on the return flow of irrigation water in the Columbia River basin. In Utah Valley, Utah, deep drilling revealed previously unknown aquifers whose waters may be discharging unused into Utah Lake and could be recovered without affecting the overlying aquifers now in use. This discovery has important possibilities in many similar valleys of the Great Basin.

Studies of sediment movement in streams furnished data for Federal and State agencies planning and operating storage reservoirs, diversion works, and canal systems.

Pollution

The amount of flow in streams and the chemical and physical properties of surface and ground waters directly concern nationwide problems of pollution control and abatement. The Division exchanged data on these characteristics of water with public health agencies which collect information primarily on bacteriological pollution, and joint interpretations were made, such as those published in the pollution survey of the Ohio part of Lake Erie. As already mentioned, data on the chemical and physical characteristics of water are increasingly needed by industry to determine whether what might otherwise be an adequate supply will meet specific quality requirements. They were used in irrigation projects to control increasing concentration of mineral contaminants by the reuse of water, and also to make the waters of certain reaches of dam-controlled streams usable by determining the minimum flows necessary to flush out harmful pollution from industrial plants, sewage, and other sources. They were used in studies of ground water in relation to contamination of certain aquifiers by improperly cased wells, in mixing ground waters of varying chemical qualities, in surface disposal of wastes, and in encroachment of fresh-water aquifiers by oil-field brines and ocean water.

In 1952 the Division received 1,700 requests for specific information on pollution of water.

Interstate and International Allocations of Water Resources

Because the data collected by the Division are more comprehensive than any other, and because they are unbiased, they are considered prima facie evidence in courts of law, and they are the basis for the division of water among States having interstate compacts. Eleven compacts are now in force and two providing for division of the waters of the Yellowstone River (Montana and Wyoming) and the Bear River (Idaho, Utah, and Wyoming) are being negotiated.

International problems relating to water are increasing. In 1952 several special investigations of water resources were made for presentation to the International Joint Commission, United States and Canada, relating to the Columbia River basin, the Waterton and Belly Rivers in Montana, the Souris and Red Rivers in North Dakota and Minnesota, and the St. John River in Maine. International studies of the St. John are especially timely because of rapidly rising needs for power in the region.

Using funds transferred by the Department of State, the Division is continuing the investigations needed for the division and control of waters in the St. Mary and Milk Rivers, for the determination of the effects of operations in the Kootenai and Columbia River basins, and to provide data for further studies in other international waters.

The Geological Survey, through another agreement with the Department of State, has continuing obligations for obtaining water-resources information along the Mexican boundary, as required by the treaty of 1944.

In 1952 the Division received 200 requests for specific information relative to interstate and international allocations, and 200 requests relative to domestic litigation.

Soil and Moisture Conservation

To protect the nationally owned lands of the West that are under the custody of the Department of the Interior and to maintain these lands at a high level of productivity, the Division continued a program of consulting, exploration, and research in relation to the soil and moisture conservation program of the Interior Department. In 1952 new sources of water were discovered and much additional arid and semiarid land was put to better use. The Division, in collaboration with other Bureaus of the Department, examined and reported upon critical soil-erosion problems and evaluated methods for conserving soil and moisture. It surveyed many reservoirs to determine the rate at which they were being filled with sediment and the amount of erosion taking place upstream.

Missouri River Basin

Investigation of the water resources of the Missouri River basin for the Bureau of Reclamation and the Corps of Engineers was curtailed, because of a 30 percent reduction in funds from those allocated for 1951. The Division's work included: Measurements at 290 stream-gaging stations; 53 studies related to ground-water supplies or to changes in ground-water conditions that may result from reservoir construction or irrigation in the vicinity of reclamation units; more than 50,000 measurements of the sediment content of surface waters; 10,000 analyses of the chemical quality of waters at 54 stations; 1,300 chemical analyses of ground waters; and hydrologic and utilization studies related to the proposed plans for development.

Mutual Security Aid

Under the terms of the Mutual Security Act, water-resources projects were continued in Saudi Arabia and India and additional personnel were assigned to the former. An adviser was assigned to the study of 2,000 irrigation wells in the Ganges Plain in India. New ground-water investigations were begun in Iran and Libya, and a surface-water study was planned for Afghanistan. A discharge integrator was built for Chile.

Nationals of Mexico, Brazil, Canada, India, and other countries received training in ground-water field offices in the United States.

Other Work

The National Military Establishment depends on the data collected by the Water Resources Division for the location, operation, and expansion of the plants that it operates and those leased for operation. In 1952 it made 200 specific requests for water-resources information. Choice of the site near Portsmouth, Ohio, for a new atomic energy plant was determined in part on the basis of routine water-resources studies made over a period of many years.

Five hundred requests for information about drainage problems were answered. Canals draining large swamp areas in east-central

Florida were gaged and their operations studied, and methods were proposed for draining certain water-logged irrigated lands in the West.

Besides undetermined use of water-resources records in studies of land use or treatment, the Division received 300 specific requests for this type of data. Because knowledge of the effects of land use on headwater drainage, streamflow, sediment discharge, and ground water is inadequate, many water-development projects have been planned and constructed without full realization of the effects on total water resources. Benefits attributed to these developments are often unsupported by technical data, and apparent benefits may be achieved in one area at the expense of areas downstream.

In 1952 the Division undertook an extremely small-scale study of the natural, or "background," radioactivity of our water resources, and preliminary data were gathered on a few representative water samples. With the increased emphasis that seems sure to be placed on this work, it is expected that the information will have many valuable uses in public and private enterprises because it shows the radioactivity of surface and ground waters in relation to geologic formations, public and industrial water supplies, and agricultural and other uses. The study may lead to the finding of new sources of fissionable material, to important but unforeseen scientific principles, and to information that may be vital to public health in times of peace or war when accidentally or deliberately radioactive materials may be introduced into water bodies.

Among other accomplishments were: Several producing water wells were completed for the Bureau of Indian Affairs on Navajo and Hopi reservations where there was scanty ground water; the geology of the area is so complicated that random drilling was hopeless. In the Trust Territories and other areas of the Pacific, supplies of ground water were located and evaluated at places where ground water was ordinarily considered unavailable. Preliminary consideration was given to the use of data on our water resources for determining rates of flood insurance.

Research and Technical Developments

To keep abreast of the increasing needs for a greater water supply of better quality, the Division is continuously engaged in research and in the development of new techniques and devices to increase the amount and accuracy of its work at a lower cost. At least 18 research and technical development programs were begun or completed in the year.

One of these, a study at Lake Hefner, Okla., to develop basic methods for measuring evaporation from reservoirs, was essentially and successfully completed. The three methods evolved by the Division, in cooperation with the Bureau of Reclamation, the Navy Electronic Laboratory, and the Weather Bureau, now make it possible to determine the amounts and rates of losses from any reservoir, and application is now being made at Lake Mead, the key reservoir in the management of the lower Colorado River. Because the demand for water in the arid part of the West is far greater than the present supply, application of the methods can be made to the design and efficient operation of the many thousands of large and small reservoirs there and elsewhere. Further tests are under way to determine whether the same principles can be applied to the determination of water losses by vegetation.

Studies of the disposal of septic-tank effluent near Paducah, Ky., showed that the effluent could be safely drained into permeable but unsaturated rock units; research is needed on the hydraulics of such operations. Work at El Paso, Tex., showed the possibility of artificially charging the aquifers there through wells.

Investigations at Huntsville, Ala., showed that the occurrence of ground water is controlled by the structure of limestone strata in a way not previously observed. This discovery is of potential importance in finding and evaluating the supply of ground water in limestone in other areas.

Plans were made to study the effect of movements of ground water on the accumulation of oil and gas, as suggested by a geologist in private employment. This might lead to the location of new petroleum resources in areas now considered barren.

The Division is continuing its studies of the way in which sediment originates, enters the stream channel, is moved along, and is finally deposited. Included also are the problems of scour and fill. In cooperation with the Bureau of Reclamation, the study of the amount of sediment transported as bed load, rather than suspended load, was continued at several sites in the Missouri River basin.

The recharge, flow, and discharge of ground water in certain aquifers present problems that can now be solved only with difficulty or not at all. Consequently, a study is being made of numerical methods, and of the possibility of using electronic computing machines instead of tedious calculations, to measure areal ground-water recharge, flow, and discharge. This study is an outgrowth of an investigation at Eagle Lake, Ind., to determine the effect of proposed drainage ditches on regional lake and water-table levels and ground-water recharge.

To compensate in part for the scarcity of experienced hydrologists and geologists, the Ground Water Branch organized a series of groundwater short courses and issued the first of several Ground Water Notes embodying results of past and current hydrologic research not heretofore available to newer personnel.

Several technical devices or techniques to conserve labor and costs were developed or were in the process of development. The use of electronic machines to compute stream-discharge records was investigated and appears favorable, but further investigation is needed. The use of reflected sound waves to determine the nature of the foundation at the site of a potential major engineering structure in Maine and to determine the thickness and character of bottom sediments in another area proved valuable.

Research was continued on the use of electric logs of wells to determine, not only the mineral content, but the approximate concentrations of different ions in the waters of the different aquifers. A technique was devised for introducing measured volumes of water into wells to provide quantitative data on the value of the wells as indicators of water levels in aquifers and on the productivity of their aquifers. The use of an electronic tube to determine the verticality of wells was being tested. If successful, it will be much less expensive than present well-surveying methods. An electrically operated water-stage recorder was developed for use in wells too small or too deep for standard floats. It will make possible the collection of continuous water-level data at less cost than before. Eight-day recording gages have been converted for 30-day operation by means of an inexpensive battery-operated clock escapement; considerable economy in recorder cost and observers' visits will result. Continuous water-temperature recorders are being installed at gaging stations to provide temperature data for ready consultation by industry.

Improved analytical and instrumental techniques for analyzing water were emphasized in 1952. The slower gravimetric and volumetric methods of making analyses are giving way to the fuller utilization of electronic laboratory equipment like the spectrophotometer, flame photometer, and potentiometer.

Reports on Investigations

The optimum development and use of our water resources is facilitated by the publications of the Division. The availability of these records and interpretations of them is made known through public announcements issued to the press and to individuals who request the information. Stream-flow and ground water conditions in the United States and Canada were summarized monthly and semiannually in the publication, Water Resources Review.

In 1952 the Division published 34 water-supply papers, including the annual "Surface water supply of the United States," "Quality of surface waters in the United States," and "Water levels and artesian pressure in observation wells in the United States"; and 22 circulars. Eighty-three manuscripts were transmitted to technical journals for publication, 47 were transmitted to State agencies with whom cooperative work was done, 48 to other Federal agencies, and 49 reports were completed and placed on open file in one or more Geological Survey offices in the area described.

Compilation and condensation into one volume for each area was begun of all surface-water records prior to 1950. This is being done to increase their degree of accuracy and completeness by incorporating revisions, and to facilitate their use. At present a single inquiry for information may lead the searcher into as many as 50 separate volumes.

CONSERVATION DIVISION

The Conservation Division classifies the Federal lands as to mineral and water resources and supervises mineral-recovery operations under leases, permits, and licenses on Federal, Indian, and naval petroleum reserve lands. A small headquarters staff and a field staff of competent geologists and engineers are maintained. This force makes field surveys, prepares maps and reports dealing with water power, fuels, minerals, and chemicals essential to the mineral-resource economy of the United States, and conducts on-site supervision of mining and drilling operations necessary to assure the safe and economical production by private enterprise of coal, oil, gas, and other minerals.

Mineral Classification

All phases of the service rendered by the Mineral Classification Branch were maintained at a markedly accelerated pace throughout fiscal year 1952. In all, some 28,057 cases involving either the outright disposal of Federal lands with no reservation of any mineral, the disposal of such lands with the reservation of one or more specified minerals, or the exercise under the Federal leasing laws of the Government's right to lease for exploration and production, by private enterprise, one or another minerals substance from lands under its jurisdiction were acted upon during the year. This represents an increase of 65 percent as compared with 1951, and was wholly in phases concerned with the clearance of applications for mineral rights under the leasing laws applicable to public and acquired lands. In addition, the Branch prepared and promulgated initial or revised definitions of the known geologic structure of eight producing oil and gas fields containing Federal lands and revoked one such definition; appraised geologically submissions of 182 unit-plan and participating-area proposals; drafted 23 determinations of leasehold relations to the productive limits of oil and gas deposits as found to exist on August 8, 1946; reported for appropriate administrative action the fact and geologic significance of 123 new discoveries of oil or gas made on or affecting Federal-land leaseholds; recommended the competitive sale of oil and gas leases on 30 parcels of public land; appraised geologically 1.173 applications for rights-of-way across public lands; and prepared 58 miscellaneous reports on the mineral potentialities of specified lands for various agencies of the Federal Government and inquiring individuals.

From field offices in Colorado, Wyoming, Montana, California, New Mexico, and Oklahoma, Branch geologists made "demand" or specific investigations which resulted in geologic reports and maps for official use by the Washington staff, by other branches of the Conservation Division, and by other bureaus of the Interior Department concerned with mineral and water-power conservation and administration. The Branch completed reports on the coal resources of Middle Park, Grand County, Colo., of an area near Pinto, Iron County, Utah, and of an area near Douglas City, Trinity County, Calif.; on the geology of dam and tunnel sites in the Thomas Bay area near Petersburg, Alaska, and of the mile 1865 dam site on Rogue River, Jackson County, Oreg.; also maps showing areal geology, structure contours, and oil development in the Gillette-Douglas-Lusk-Newcastle district and the Sussex-Meadow Creek district in the Powder River Basin, Wyo.; and a structure-contour map of the plains area of eastern Colorado.

Water and Power Classification

The field work of the Water and Power Branch during 1952 was directed mainly toward obtaining basic information on the water-power resources and storage possibilities of Federal lands on which projects were proposed for early development. Work was done in Alaska, New Mexico, and in the Colorado and Columbia River basins. Topographic surveys were made of one reservoir site, eight dam sites, and 41 miles of river channel. Geologic investigations of six dam sites were made. Supervision of construction and operation was given to 134 power projects under license with the Federal Power Commission, to 606 such projects under permit or grant from the Department of the Interior, and to 200 in cooperation with the Bureau of Indian Affairs.

Classification activities resulted in the addition of 84,576 acres to power-site reserves and elimination of 9,868, increasing the outstanding reserves in 23 States and Alaska to a net total of 6,925,770 acres.

Maps published covered 89 miles of stream channel of four rivers in seven dam sites.

Final action involving hydraulic determination was taken on 662 cases received from departmental sources and the Federal Power Commission and on 5,354 cases that also involved mineral classification.

Investigations were in progress on the power and water-storage possibilities of 46 rivers. Three reports on power possibilities of certain streams were completed, as were three reports on nine dam sites. The reports have been made available for public inspection.

Mining Branch

The Mining Branch is responsible for the supervision of operations concerned with the discovery and production of coal, potassium, sodium, phosphate, and oil shale from all public-domain lands; of sulfur on public lands in Louisiana and New Mexico; of silica sand on certain lands in Nevada withdrawn by Executive Order No. 5105; of gold, silver, and mercury on certain Spanish land grants; of all minerals except oil and gas on acquired lands under the act of August 7, 1947, and provisions of section 402 of the President's Reorganization Plan No. III of 1946, and on segregated restricted, and tribal Indian lands. Outstanding mineral leases and permits on acquired and Indian lands include copper, nickel, gold, silver, manganese, uranium, asbestos, limestone, gravel, coal, sand, marble, silica rock, iron, gypsum, vermiculite, pumice, clay, bentonite, phosphates, fluorspar, feldspar, lead, zinc, barite, mica, tungsten, and garnet.

The Branch has the responsibilty of reporting on applications for leases and prospecting permits; recommending lease terms; enforcing regulations and lease terms governing the conduct of prospecting, mining, and beneficiation operations, and the safety and welfare of employees; protecting natural resources and preventing waste; determining royalty liability of lessees and permittees; preparing statements of accounts; and receiving payment of royalties and rentals. The Branch acts in an advisory capacity to the Office of the Secretary and to other bureaus of the Department in handling of leases, permits, and licenses.

As of June 30, 1952, there were under supervision 1,198 properties under leases, permits, and licenses, of which 833 were on the public domain, 82 on acquired lands, and 283 on Indian lands. These concerned lands in 16 States west of the Mississippi River, in 11 Eastern States, and in Alaska. Production from lands under supervision during the year is estimated at 16,007,000 tons, valued at $110,030,000, with accrued royalties amounting to $3,761,000, as compared to a production of 19,133,000 tons, valued at $106,735,000, and a royalty of $3,844,000 during the previous fiscal year.

The production of coal from public lands in the United States and Alaska, including the former Choctaw-Chickasaw segregated coal lands in Oklahoma, was about 8,106,000 tons, as compared with 8,946,000 tons mined during the previous fiscal year from the same lands. Increased competition from other fuels and a prolonged strike in the steel industry, with consequent general industrial slowdown, account for the lower production.

Potassium production is estimated at 5,402,000 tons of salts, as compared with actual production of 5,393,000 tons during the fiscal year ended June 30, 1951, and 4,423,000 tons during the fiscal year ended June 30, 1950. One of the new producers in the New Mexico area, the Duval Sulphur & Potash Co., began operations in December 1951 and by May 1952 had reached planned capacity. Two shafts were sunk to the ore horizon and connected underground by the Southwest Potash Co. Southwest's construction program on June 30 was about 90 percent complete. Production is expected by October 1, 1952. Improvements by other producers include sinking of three new mine shafts and the beginning of a fourth, in addition to expanded refinery facilities to a value in excess of $14,000,000. Eighty-seven core tests, aggregating 100,523 feet of hole, were drilled for potash during the year. As of June 30, there were 194 potash permits in effect.

The principal source of sodium from public lands was from the potassium leases on the Searles Lake brine deposit in California, amounting to 581,962 of the total of 593,736 tons produced from all Federal leases in the Nation. Refined salts produced from these brines include potassium chloride, borax, soda ash, salt cake, bromine, burkite, and sodium lithium phosphate. During the year, operations under 92 sodium-prospecting permits were supervised in the States of California, Nevada, New Mexico, North Dakota, Oregon, Utah, and Wyoming. The Intermountain Chemical Co., now operating on Government and adjoining Union Pacific Railroad lands near Green River, Wyo., is at present constructing a soda-ash refinery at the mine site, costing in excess of $16,000,000.

Phosphate leases on public lands in Arizona, Idaho, Montana, and Wyoming increased from 33 to 37 in the fiscal year. In addition, there are 33 phosphate leases on Indian lands in Idaho and 1 phosphate lease on acquired land in Florida. Phosphate production during 1952 was 663,843 tons, as compared to 479,181 tons in the previous year. Three additional electric furnaces were under construction in Western States as of June 30—one by Westvaco Chlorine Products Corp. at

Pocatello, Idaho, a second at Soda Springs, Idaho, a third by the Victor Chemical Co. at Silver Bow, Mont. The capacity for the production of elemetal phosphorus in Western States will be doubled during the coming fiscal year. For the first time, elemental phosphorus from western furnaces is available for fertilizer purposes.

Production of lead and zinc concentrates from Quapaw Indian lands in Oklahoma amounted to 55,000 tons, as compared to 53,755 tons produced in 1951. The tonnage of ore mined is greater, but the grade of ore is slightly lower. Substantial tonnage of uranium-vanadium ores was mined from Indian lands in Arizona, New Mexico, and Utah.

Coal, fluorspar, quartzite, sandstone, bentonite, mica, and feldspar accounted for most of the production from acquired lands. A phosphate lease for the development of a colloidal phosphate deposit in Florida and manganese-clay leases involving acquired lands in Tennessee were issued during the year. Wide interest is shown in land valuable for manganese in Virginia, Kentucky, and Tennessee.

Of the total of 87 awards in 1951 for achievement in safety of mine operations by the Joseph A. Holmes Safety Association to coal mines in the United States, 13 were made to mines west of the Mississippi, and of these 5 were made to coal mines operating on public-domain lands. One of six awards in the industrial minerals group was received by a potassium lessee. The Sentinels of Safety award for bituminous coal mines has been made to one lessee for the thirteenth year in the 19 years it has been in competition. Only one such award is made to an industrial group each year. These recognitions for safety achievements attest the cooperation of mine management and employees in the conduct of mine operations on Government lands.

Oil and Gas Leasing Branch

The Oil and Gas Leasing Branch supervises operations for the discovery, development, and production of crude oil, natural gas, and products extracted from natural gas on public, acquired, and Indian lands. These duties were carried out during the year by means of 5 regional offices and 20 district offices at 18 separate locations in California, Colorado, Montana, New Mexico, Oklahoma, Utah, Wyoming, and Washington, D. C.

On the public lands, 63,164 oil and gas properties were under supervision at the end of the fiscal year, aggregating 48,562,880 acres in 23 States and Alaska, an increase of 62.3 percent in the number of properties and 63.1 percent in the acreage under supervision at the close of the previous fiscal year.

Drilling on public lands during the year included the spudding of 1,128 wells and the completion of 1,034 wells, of which 668 were productive of oil and gas and 366 were barren. In all, 16,884 wells, including 9,662 capable of oil and gas production, were under supervision on June 30, 1952. The production from petroleum deposits on the public lands in 1952 was appreciably greater than in 1951. Production from the public lands in fiscal year 1952 was about 91,973,000 barrels of petroleum, 158,130,000,000 cubic feet of natural gas, and 178,014,000 gallons of gasoline and butane, with royalty returns to the United States of about $27,378,000.

There were 1,362 acquired land leases, embracing 1,244,766 acres in 26 States under supervision at the close of the fiscal year. Drilling on acquired lands during the year included the spudding of 94 wells and the completion of 86 wells, 66 of which were productive of oil or gas and 20 of which were barren. In all, 275 acquired-land wells, including 207 capable of oil or gas production, were under supervision on June 30, 1952. The production from acquired lands in fiscal year 1952 was about 4,047,000 barrels of petroleum, 5,482,370,000 cubic feet of natural gas, and 3,300,000 gallons of gasoline and butane, with royalty returns of about $1,427,000.

The Branch supervised operations on 7,737 leaseholds on Indian lands in 16 States, which contained at the end of the year a total of 8,696 wells, 4,172 of which were productive of oil or gas and 270 of which had been completed in the year. The total revenue from royalties, rentals, and bonuses amounted to $15,403,900.

On behalf of the Department of the Navy, supervision was continued over the production of oil, gas, gasoline, and butane from 17 properties under lease in Naval Petroleum Reserve No. 2 in California. Production from 262 active wells in this reserve totaled 2,304,000 barrels of petroleum, 1,147,000,000 cubic feet of natural gas, and 8,185,000 gallons of natural gasoline and butane, with an aggregate royalty value of $816,550.

On Department of the Army lands in the Rio Vista gas field, the work included the consideration of revisions to the compensatory royalty agreements, approval of a number of revisions in participating percentages for these lands, and the computation of royalties due the United States. The gas production allocated to the lands was 3,559,000,000 cubic feet, with a royalty value of $416,263.

Activities toward unitization of oil and gas operations involving Federal land were reflected in the approval of 68 new unit plans during the year and the termination of 19 previously approved unit plans, leaving 227 approved plans, covering 3,606,825 acres, outstanding on June 30, 1952. About 49.23 percent of the petroleum obtained from public lands during the year was produced under approved unit agreements, 37.29 percent of the natural gas, and 66.16 percent of the gasoline and butane. In addition, 6 Indian-land unit agreements covering 51,254 acres were approved in the year, making a total of 14 such approved plans covering 87,320 acres outstanding on June 30, 1952. Also, 43 drilling-unit agreements were approved during the year, making a total of 176 approved as of June 30, 1952; these agreements involve isolated small tracts, which are consolidated to form a logical drilling unit and, in effect, constitute an agreement similar to a unit agreement, though involving only a small segmet of a single field or pool.

WORK ON PUBLICATIONS

Texts

During the year 174 new manuscripts were received by the Section of Texts, 174 manuscripts were sent to the printer, and 158 publications were delivered by the printer. Work on these included 15,050 pages of manuscript edited and prepared for printing; 1,949 galley proofs and 7,064 page proofs revised and returned; indexes prepared for 41 publications, covering 2,075 pages and consisting of 6,279 entries. Copy edited in preparation for mimeographing included 83 pages of miscellaneous material.

Reports delivered were as follows: Professional Papers 142–I, 221–E, 221–F, 221–G, 221–H, 222, 223, and 229; Bulletins 955–D, 955–E, 955–F, 962–B, 962–D, 963–B, 963–C, 963–D, 964–D, 964–E, 965–B 969–A, 969–B, 969–C, 969–D, 969–E, 973–A, 974–A, 974–B, 974–C, 976–B, 976–C, 976–D, 977, 978–A, and 981–A; Water-Supply Papers 1050, 1068, 1072, 1081, 1085 1092 1093, 1095, 1096, 1097, 1098, 1100, 1101, 1104, 1112, 1113, 1114, 1115, 1116, 1117, 1118, 1119, 1120, 1121, 1122, 1124, 1127, and 1149; Circulars 40, 67, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 89, 90, 91, 92, 94, 95, 97, 98, 99, 100, 101, 102, 103, 104, 105, 108, 110, 111, 112, 113, 114, 115, 121, and 123; Topographic Instructions, chapters 2A1, 2D1, 2D2, 4D5, and 6A3; and miscellaneous reports. These reports cover a wide range of subject matter—general geology of particular areas; mining districts, and local mineral deposits in the United States, Alaska, Brazil, Hawaii, Mexico, and Palau Island; studies of fossils and the rocks in which they are found; a collection of papers on geochemical research; geophysical abstracts, a quarterly serial; measurements of stream-flow and of water level and artesian pressure in wells; general studies of ground water and of the occurrence of floods, with consideration of the influence of geology and physiography.

In order to keep the public informed, 12 lists of new publications were issued. Also printed during the year were 29 State index circulars; 34 pamphlets to accompany index circulars; and the Second Supplement to Publications of the Geological Survey, 1948. Copy for the third supplement was prepared.

Illustrations

Of a total of 38 reports on hand at the beginning of the fiscal year, 21 were in various stages of completion. Fifty-two reports were received during the year. Thirty-one reports were completed and transmitted for publication and 1 was withdrawn, leaving a total of 58 reports on hand, 41 of which were in various stages of completion. Those transmitted included 14 professional papers, 10 bulletins, and 7 water-supply papers, which contained 1,747 completed drawings and photographs. Illustrations were prepared for 46 circulars. In addition, a large number of miscellaneous pieces of drafting were completed, including 14 geologic quadrangle maps, and 10 geologic sections in cooperation with the State of Tennessee.

Map Reproduction

In the fiscal year, 14 newly engraved topographic maps, 767 multicolor topographic maps, 9 river survey maps, 5 planimetric maps, 5 geologic index maps, 18 topographic index maps, 64 geologic preliminary maps, and 15 special maps were printed, making a total of 897 new maps printed and delivered. Reprint editions of 112 engraved topographic maps, 41 multicolor maps, and 59 photolithographed State, geologic, planimetric, preliminary, and other maps were printed and delivered. Of new and reprinted maps, 1,109 different editions, amounting to 2,622,529 copies, were delivered.

Work was done for 39 units of the Government, including branches of the Geological Survey, and for the States. Charges for this work amounted to $837,044.14, for which the Geological Survey appropriation was reimbursed.

Transfer impressions and velox impressions numbering 535 were made during the year.

Including topographic maps and contract and miscellaneous work of all kinds, 2,840,708 copies were printed and delivered.

The photographic laboratory made 7,133 photolithographic negatives, 2,246 photographic negatives, 11,092 prints, and 611 lantern slides; developed 34 film packs and 84 rolls of film; and developed and printed 23,050 feet of aerial film. The Photo-Process Section made 5,953 photolith press plates. The Hand Transfer Section made 592 printing plates.

Distribution

In the fiscal year 1,275 publications were received. These comprise 134 new book reports and pamphlets, and 12 reprints; 14 oil- and gas-investigations maps and charts, 2 coal-investigations maps, 32 geophysical-investigations maps, and 59 other geologic maps; 10 river surveys; 811 new topographic and other maps and indexes; and 201 reprinted maps.

The total units received numbered 224,228 books and pamphlets, 44,500 copies of revised index maps, and 2,717,789 topographic and other maps, making a grand total of 2,986,517.

Units distributed included 79,560 books and pamphlets, 583 geologic folios, and 1,616,594 maps, 73,679 topographic indexes—a grand total of 1,770,416, of which 569 folios and 1,017,081 maps were sold. Distribution of maps and folios was divided among Survey offices as follows:

Washington	1, 035, 889
Denver	572, 112
Other field offices	8, 593
Total	1, 616, 594

The net proceeds from sales of maps and folios amounted to $244,847.27. Money received from the offices is as follows:

Washington	$171, 550. 78
Denver	69, 917..94
Other field offices	3, 378. 55
Total	244, 847. 27

In addition, $25,622.04 was repaid by other Government agencies for maps or folios furnished. The total net receipts for maps and folios, therefore, amounted to $270,469.31, an increase of $86,974.02 above fiscal year 1951.

Local Washington over-the-counter sale of maps amounted to $10,880.43, an increase of $4,756.71 above last year. A total of 65,728 letters were handled.

The following table shows the publications on hand July 1, 1951, those received and distributed during the year, and the totals on hand June 30, 1952:

	On hand July 1, 1951	Received	Distributed	On hand June 30, 1952
Geologic folios	12, 031		583	11, 448
Maps and indexes	21, 595, 982	2, 762, 289	1, 690, 273	22, 667, 998
Books and pamphlets	402, 094	224, 228	79, 560	546, 762
Total	22, 010, 107	2, 986, 517	1, 770, 416	23, 226, 208

FUNDS

During the fiscal year 1952 obligations were incurred under the direction of the Geological Survey totaling $48,050,356. Of this amount 46 percent was appropriated directly to the Geological Survey, 43 percent was made available by other Federal agencies, and 11 percent by States and their political subdivisions.

Obligations incurred by the Geological Survey in fiscal year 1952 (by source of funds)

Topographic surveys and mapping:	
Geological Survey appropriation	$8,386,291
States, counties, and municipalities	1,782,607
Department of the Interior: Bureau of Reclamation	2,221,104
Department of Defense:	
Department of the Air Force	811,037
Department of the Army	4,772,358
Miscellaneous Federal agencies	479,992
Sale to the public of aerial photographs and photographic copies of records	31,682
Total	18,485,071
Geologic and mineral resource surveys and mapping:	
Geological Survey appropriation	5,763,026
States, counties, and municipalities	212,383
Department of the Interior:	
Bureau of Indian Affairs	4,908
Bureau of Mines	6,876
Bureau of Reclamation	376,434
Defense Minerals Exploration Administration	269,716
Petroleum Administration for Defense	39,823
Department of Defense:	
Department of the Air Force	31,374
Department of the Army	994,336
Department of the Navy	454,002
Department of State	483,604
Atomic Energy Commission	5,799,356
Defense Materials Procurement Agency	89,047
Mutual Security Administration	240,729
Miscellaneous Federal agencies	35,065
Total	14,800,679
Water resources investigations:	
Geological Survey appropriation	5,846,84
States, counties, and municipalities	3,285,150
Department of the Interior:	
Bonneville Power Administration	17,91
Bureau of Indian Affairs	112,37
Bureau of Reclamation	1,269,38

Water resources investigations—Continued	
Department of Defense:	
Department of the Air Force	$28,002
Department of the Army	871,374
Department of the Navy	79,880
Department of State	131,375
Atomic Energy Commission	280,132
Tennessee Valley Authority	91,658
Miscellaneous Federal agencies	360,266
Permittees and licensees of the Federal Power Commission	67,146
Total	12,441,511
Soil and moisture conservation: Geological Survey appropriation	43,700
Classification of lands:	
Geological Survey appropriation	358,612
Miscellaneous Federal agencies	537
Total	359,149
Supervision of mining and oil and gas leases:	
Geological Survey appropriation	925,583
States, counties, and municipalities	12,111
Department of Defense: Department of the Navy	30,874
Miscellaneous Federal agencies	4,064
Total	972,632
General administration:	
Geological Survey appropriation	540,409
Department of the Interior: Bureau of Reclamation	83,620
Department of Defense:	
Department of the Air Force	19,400
Department of the Army	179,758
Department of the Navy	13,912
Department of State	13,599
Atomic Energy Commission	80,665
Miscellaneous Federal agencies	16,251
Total	947,614
Summary:	
Geological Survey appropriation	21,864,469
State, counties, and municipalities	5,292,251
Other Federal agencies	20,794,808
Permittees and licensees of the Federal Power Commission	67,146
Sale to the public of aerial photographs and photographic copies of records	31,682
Grand total	48,050,356

OIL AND GAS DIVISION

Hugh A. Stewart, Acting Director

Some functions of the Oil and Gas Division, particularly those concerned with petroleum defense mobilization, had been transferred to the Petroleum Administration for Defense during the previous fiscal year. Many of the normal long-range peacetime functions, including the following, were continued.

The Division represented the Department in all matters affecting export policy and export control on Department of Commerce committees and task groups dealing with such matters, and by close working relationships with other agencies within the Department were able to bring to the Department of Commerce committees, Interior's views on those matters with which the Department is properly concerned.

The Oil and Gas Division served as consultant on oil and gas to the Department's Division of International Activities and assisted in representing the Department on the Interdepartmental Committee on Trade Agreements under the auspices of the Department of State. It also participated in the activities of the Department of State country committees and took part in renegotiation of trade agreements with Venezuela and Argentina.

The Division represented the Department at the quarterly meetings of the Interstate Oil Compact Commission. It maintained liaison directly with State regulatory bodies and also through the Federal Petroleum Board, which administers the Connally "Hot Oil" Act, under supervision of the Division.

During the year the services of the National Petroleum Council were used not only by the Oil and Gas Division, but also by the Bureau of Mines and the Petroleum Administration for Defense. Fourteen technical studies were made.

On January 7, 1952, by Amendment No. 1 to Order No. 2562, the functions of the Military Petroleum Advisory Board were transferred to the Petroleum Administration for Defense. This order preserved the Board as a stand-by ready to be brought into action in the future.

Conservation of petroleum within the United States was one of two principal ends which Congress had in view when it passed the Connally "Hot Oil" Act in 1935. The other objective was to protect interstate and foreign commerce from the diversion and obstruction of, and the burden and harmful effect upon, such commerce caused by the production of oil in excess of amounts fixed under State law. When the act was passed, the latter objective was first in importance. Significant changes and developments have tended to reverse this order.

The simple and direct force of the act is exerted by banning from interstate and foreign commerce crude oil and its products produced in excess of the amounts permitted to be produced under the laws, rules, and regulations of a State. It is administered by the Federal Petroleum Board, under the supervision of the Oil and Gas Division.

The Board, with headquarters at Kilgore, Tex., consists of a chairman, member, and alternate member, and operates through a staff of approximately 25 persons, 14 of whom are examiners, the others clerical and accounting personnel. Regional offices are located at Midland, Tex., where the alternate member is in charge, at Houston, Tex., and Lafayette, La.

While the act is applicable wherever State laws limit the rate of production and prescribe conditions for producing and handling of oil, its chief application lies in the States of Texas, Louisiana, and New Mexico, where regulations prescribed under the act are actively enforced. So far as possible with the resources at its command, the Board enforces the provisions of the act in other oil-producing States, particularly in Mississippi, Oklahoma, Arkansas, and Kansas.

The primary aim of the Board is to secure the widest possible voluntary compliance with the provisions of the act. Sanctions for violations are judicially applied only where violations are determined to be of a substantial character, knowingly done or caused. Investigations are constantly in progress throughout the areas where experience demonstrates violations occur most frequently, and they serve the dual purpose of deterring many from disregarding the law and of bringing to justice those guilty of the more serious offenses against it. For the same purpose and with like effect, producers, transporters, refiners, and others handling oil and products in the designated area are required to keep prescribed operating records and file monthly reports with the Board on approved forms.

Cooperation between the Board, the petroleum industry, and State conservation agencies operating in the various oil-producing States, always of prime importance in achieving the purposes of the act, continues with mutually beneficial results. In order that the burden upon the industry may be kept at a minimum, the regulations prescribed under the act limit the requirements for the keeping of daily operating records and the filing of reports to only those areas, defined and known as the designated area, where experience shows infractions of the law occur most frequently, either because of wide differential between potential and permitted production, or the presence of some other factor or factors tending in that direction. Presently, the designated area consists of 106 counties in the State of Texas, the counties of Lea and Eddy in the State of New Mexico, and the entire State of Louisiana.

From this designated area the Board receives and processes, each month, approximately 5,700 monthly producers reports, about 600 monthly pipeline reports, and slightly less than 100 refiners and processors reports. These reports cover operations in nearly 1,400 separate oil fields and account for more than 38 percent of the entire domestic production of crude oil, or approximately 2,384,408 barrels daily—some 74,000,000 barrels monthly.

At the beginning of the fiscal period, 17 cases dealing with violations of the act were pending, 5 in an investigative status, 3 pending review by the Board, one awaiting administrative action by the Oil and Gas Division, one under review by the Department of Justice in Washington, 5 pending disposition by the United States attorneys, and 2 pending in the Federal courts.

Notwithstanding the reduction of the investigating staff from 14 to 10 examiners during the year, due to reduction in appropriations, formal investigations were initiated in 10 new cases, making a total of 27 cases receiving consideration during the period, 14 of which were closed before the close of the year, one by grand jury no bill, three administratively without prosecution, and 10 by successful prosecution. Fines assessed aggregrated $38,930, comparing with $33,000 for the year 1951 and $52,950 for the year 1950. Prosecution by local authorities in Mississippi based upon evidence supplied by the Board also resulted in fines of $6,000.

DIVISION OF LAND UTILIZATION

Lee Muck, Director

This is the first full year under the instructions issued by the Secretary in order No. 2600 whereby the Division would provide "* * * technical staff assistance for the Assistant Secretary for Public Land Management on land use and community services management and in the development and coordination of programs in these areas." In accordance with this order the program of the Division has expanded along three major categories, namely: staff services, operational programs, and long-range programing.

STAFF SERVICES

The staff services rendered by the Division do not lend themselves to either qualitative or quantitative analysis. Essentially these staff services are those of review of proposed actions to insure accuracy, coordination, and compliance with departmental policy. Included as an important segment of staff services is the technical review in a consulting and advisory capacity of all matters of concern to the Assistant Secretary for Public Land Management. Some of the diverse matters to which attention was given by the Division during the year include a revised freight tariff structure for The Alaska Railroad, the concessions policy for the national parks and monuments, and the proposed encroachment by commercial interests at certain national wildlife refuges.

Also as a part of its staff service function has been representation on numerous interdepartmental committees. The Division has been represented on the staff of the Subcommittee on Benefits and Costs of the Federal Inter-Agency River Basin Committee when further consideration was given to the evaluation of water resource development projects. It has been represented on working groups on the President's Water Resources Policy Commission report and the Missouri

Basin Survey Commission. It has also been represented on the Forest Products Committee of the Munitions Board, the Lumber Committee of the Federal Specifications Board, and the Forest Products Requirements Committee of the National Production Authority.

OPERATIONAL PROGRAMS

The Division continued to supervise four programs: Soil and Moisture Conservation operation, White Pine Blister Rust Control, Forest Pest Control, and Noxious Weed Control.

Soil and Moisture Conservation

The prime objective of the soil and moisture conservation program is to restore and maintain the productive capacity of the 133,000,000 acres of public and Indian land seriously damaged by erosion and misuse. This critical area amounts to 47 percent of the lands in the United States under the jurisdiction of the Department on which production has been seriously impaired.

Repeatedly since 1940 this Division has reported these conditions and pleaded for a more comprehensive and intensive program of rehabilitation. Land for which the Department is responsible is still being seriously damaged. A program adequate to reverse this trend and restore all damaged land to maximum production is imperative.

Departmental lands constitute nearly 15 percent of the surface area of the United States and about 35 percent of the 11 far western States. Their impact upon the agricultural and forestry economy of the country can be tremendous. In their present condition it is believed that the range and farm lands are producing at not more than half their capacity.

The soil and moisture conservation program is responsible for the application of the measures required to build up and protect the soil and increase its production. In order to rebuild and maintain the soil entrusted to the care of this Department and arrest further depletion the soil conservation program needs to be accelerated immediately. The time schedule for the restoration of the most seriously depleted lands should be set for not more than 20 years but the current program is proceeding at a pace that will require 60 or more years.

The Secretary's Annual Report for the fiscal year 1941 set forth the policy "* * * that the most efficient and enduring type of conservation can be attained only when adequate and effective erosion-control treatments are placed where needed on a watershed basis." In the past 6 years flood control and other major river-basin programs have been accelerated to a marked degree. Meanwhile, the soil conservation program which operates in the minor drainage areas and is an essential adjunct to other water development programs has not progressed in proper proportion to them. Better coordination and integration of the land and water programs of the Department are needed to bring these programs into proper balance.

Noxious Weed Control

In the annual report for 1951, this Division reported the curtailment of production and effective use on over 25,000,000 acres of public and Indian lands by reason of the encroachment by weeds and brush. In the fiscal year 1952, Congress appropriated for the first time $2,300,000 for the control of halogeton, a poisonous weed which has forced livestock to abandon many acres of western range lands. There is indication that this weed which is spreading and becoming more intensified in the infested areas will cause even greater damage and be costly to control. Meanwhile, it has been impossible to finance the control of numerous other noxious plants such as Klamath weed and white top which continue to be serious pests.

White Pine Blister Rust Control

The objective of the white pine blister rust control program is to protect the valuable white pine stands from the ravages of the white pine blister rust—a fungus disease of foreign origin. This is accomplished by the eradication of Ribes (currant and gooseberry bushes), the alternate host of the disease.

Progress on this control activity during the year was very satisfactory. During the year 57,046 acres were covered by the three bureaus concerned and 2,519,222 ribes were destroyed. As of December 31, 1951, only 86,000 acres of the control area of over 550,000 acres remained to be worked for the first time.

Forest Pest Control

This program, which operates as a segment of the coordinated Nation-wide program for the control of forest pests on all forest lands, continued during the year. The most important diseases on which action was taken during the year were the dwarf mistletoe infection at Grand Canyon National Park, Ariz., and oak wilt at Effigy Mound National Monument, Iowa. In the insect control field relatively large control operations were undertaken against the mountain and western pine beetles in the national parks in California, as well as against the Black Hills beetle at Zion and Bryce Canyon National Parks, the walkingstick infestation at the Menominee Indian Reservation, and the Douglas fir beetle in the O and C forests in western Oregon.

LONG RANGE PROGRAMING

The bureaus concerned with reforestation work reported only 796 acres planted with trees during the fiscal year. As there are over 900,000 acres of denuded and unsatisfactorily stocked forest lands under the jurisdiction of the Department, the lack of any real progress in this important segment of the forest conservation program is very disturbing. It will be necessary to reemphasize the need to maintain all forest lands in a productive state.

During the calendar year 1951, 500,224 acres of federally owned or managed lands were burned as a result of 2,025 fires. This acreage loss is considerably below the average annual loss of 1,280,863 acres during the past 9 years. Furthermore, the number of fires is considerably below the 9-year average of 2,686. This is indicative that the fire-prevention efforts of the bureaus concerned with forest and range-fire control are beginning to show results. Moreover, the number of man-caused fires has been reduced from a high of 2,259 in 1943 to 1,569 in 1951. However, losses are still too great and there are too many man-caused fires. The fire-control efforts of all bureaus should be increased.

Considerable attention has been given during the year to the protection and management of the forest resources of Alaska. Recommendations were made to provide for the establishment of a forest pest detection and survey station in the Territory. The Congress concurred in this recommendation by providing for such a station in the fiscal year 1953 appropriation for forest pest control.

Values of stumpage continued to rise very gradually during the year. Operating within the principle to manage all commercial forests on a sustained yield basis, the Department records show that for the entire year its forests produced 1,272,772 thousand board feet of timber valued at $18,431,724.

One of the major coordination tasks of the Division in the field of resources development has been the resolution of conflicting claims for the use of water resources, usually between irrigation and power generation on the one hand and fisheries, wildlife, recreation, and preservation of scenic values on the other. Basin development plans of the Bureau of Reclamation which have been before the Department during the year in which such conflicts are involved include the Colorado River storage project and the Rogue River Basin project, a portion of the Klamath Basin project, and several small projects in which proposed reclamation works would affect national parks, monuments, wildlife refuges, or national forest wilderness areas.

In addition, the Division has participated in routine departmental review of various agency reports proposing land and water resource development projects. During the year this work involved review and comment on eight proposed projects by the Corps of Engineers, six proposed projects by the Department of Agriculture, and six project proposals by the Bureau of Reclamation.

Liaison with and service for the Departmental Advisory Committee on Conservation has been continued. The committee held two meetings during the fiscal year at which recommendations were presented to the Secretary of the Interior on various phases of nature protection.

BUREAU OF LAND MANAGEMENT

Marion Clawson, Director

INTRODUCTION

Increased emphasis on the development and use of the public lands to insure future supplies of needed materials for national growth and strength was evident in all existing and proposed programs of the Bureau of Land Management during the past year. In the fields of forestry, lands, range management, engineering and minerals, the Bureau moved into new phases of program planning as shown in its summary statement on resources and programs prepared at the year's end.

A. The Resources

1. Federally owned land and resources, under administration of BLM, are highly important in the economy of the West.

2. The demand for these resources has grown greatly in recent years and is sure to grow much more in the next few years.

3. Multiple use of these lands, on a sustained-yield basis for renewable resources and on a conservation basis for nonrenewable resources, or the use of the same tract at the same time for several purposes, is highly desirable and should be facilitated.

4. These resources should be protected against destruction and waste, should be developed to the extent necessary to obtain their beneficial use, and should be made readily available for use by the public. To the maximum extent practical, development and use into productive enterprises should be by private initiative and capital.

5. The problems of use of Federal land resources, under the Bureau administration are complex, particularly in relation to other Federal and private uses. All available assistance and technical advice from other Federal agencies and from elsewhere should be used in obtaining

full basic data for disposition or administration of the federally owned resources.

6. The full productive capacity of the federally owned resources has not yet been developed, but it is highly desirable to develop every acre to the economic limit and prevent loss of existing values by erosion and noxious plants.

7. Substantial further investment of Federal funds is necessary to repair damages resulting from past neglect if federally owned resources are to be developed to their maximum economic limit as part of the development of the area, and even though most development into productive enterprises is made by private initiative and capital.

8. Additional amounts are needed annually for administration in order to make federally owned resources fully available for use and development by private effort.

B. The Programs

1. The Bureau should continue to seek maximum efficiency—maximum output at lowest cost—in its day-to-day operations.

2. The Bureau should decentralize its operations as far as practical, both to aid in achievement of efficient operation and to make the natural resources more readily available for maximum public service.

3. The sound principle of area administration should be extended as rapidly as possible, both in the interests of economy and as a means of promoting maximum multiple-purpose use of resources.

4. BLM should seek the fullest development for the public good of the resources it administers, consistent with sound conservation practices. It should seek to increase the productivity of those resources on a sustained-yield basis, so as to provide for their maximum and continued use by authorized users.

5. In furtherance of the Bureau of Land Management's broad objectives of conservation, increased productivity, maximum utilization, selective disposal, this agency should seek best possible advice and assistance from other qualified Federal, State, and local agencies and institutions both public and private. To the fullest extent possible this advice should include duly authorized or elected representatives of the individual users—such as the district advisory boards.

6. The Bureau should analyze carefully and fully its costs of operation, its sources and amounts of revenue, and distribution of that revenue, so that the general public interest is fully protected.

7. The Bureau should seek, through regularly established channels, appropriations sufficient to attain the objectives previously outlined.

8. The Bureau should seek, through regularly established channels, any legislation needed for attainment of these broad objectives. An

analysis of the accomplishments of the Bureau of Land Management during the past year reveals that in each operating unit, including administration and the office of the chief counsel, which serve as balance wheels for the organization, the Bureau made substantial progress. On the financial scoreboard—$64,518,396.02 of revenues was recorded compared with expenditures of $12,264,564.95.

Although BLM's work primarily concerns public lands in the United States and Alaska, its specialists, on request, provide guidance in related international activities. A report on this subject is included for the fiscal year.

FOREST RESOURCES ON BUREAU OF LAND MANAGEMENT LANDS

Until recently the extent and the importance of the forest resources on lands administered by the Bureau of Land Management have not generally been known or recognized due to a lack of any timber inventory and the relative inaccessibility of forest areas. The growing significance of these forest lands is largely due to drastic changes in the economy and development of the country which have taken place in recent years. In the past, timber on most of these lands was considered to have little or no economic value. During and since World War II, better means of transportation, and migration of industry because of growing scarcity of timber in more accessible areas, have combined to create a market demand for much of this timber, and at good prices. In view of technological developments, during the past few years, it is expected that the demand will greatly increase.

A large volume of wood suitable for pulp and paper, lumber and other forest products occurs on the forest and woodland areas of the public lands. The best available estimates for the commercial forest and woodlands under jurisdiction of the Bureau of Land Management in the United States and Alaska show 259 billion board feet of sawtimber on 46½ million acres of commercial forest on public domain and O. and C. lands and 250 billion board feet on 117 million acres of woodland. The sawtimber on Bureau of Land Management lands is equal to the entire cut of softwoods in the United States for a 9-year period. While O. and C. lands have long been known as one of the Nation's most valuable timber sources, the timber on other public lands until recently has not been recognized as important.

The estimated sustained allowable annual cut of sawtimber on Bureau of Land Management forest lands is approximately 4 billion board feet, or about 10 percent of the annual national consumption. In addition, the woodland areas provide a permanent source of material for fuel wood, posts, poles and other products equivalent to an allowable cut of 2½ billion board feet a year.

Much of the timber on Bureau of Land Management lands is mature or overmature, and loss through death or decay just about offsets growth in many areas.

Forest Management Program

A comprehensive forest and woodland management program was adopted during 1952 following the annual conference of Regional Foresters. The preamble to the written plan is a forest policy statement which states that the Bureau will manage each forest and woodland type to obtain its maximum permanent benefits; recognize woodland and forest lands which should be retained under public management and stabilize their tenure; protect the woodland and forest areas to assure the management objectives; and develop and pursue programs leading to optimum utilization of woodland and forest products.

In line with that policy, approximately 112,000 acres of public domain forest land in Arkansas was reserved by Public Land Order 834 of May 23, 1952, for management under a sustained-yield forestry program by the Bureau.

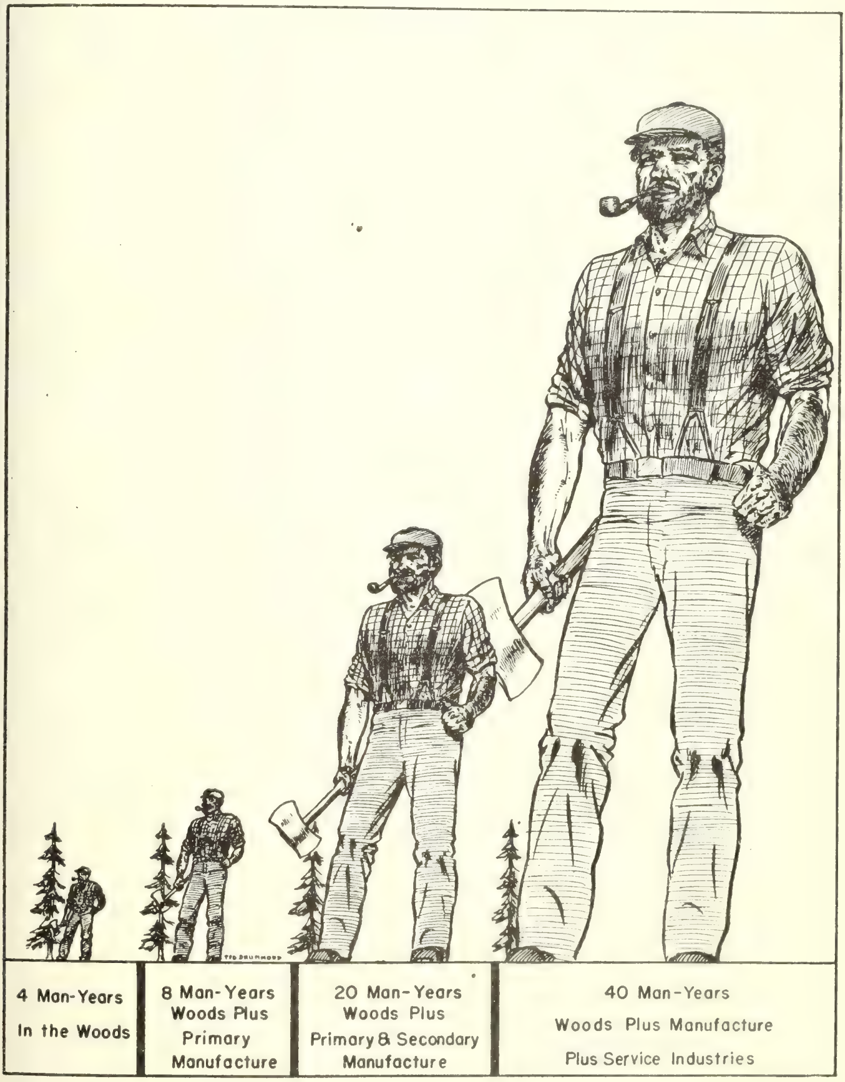
The most immediate benefits of sustained-yield management are to develop permanence and economic security for communities whose industries are largely dependent upon timber. The transitory type of lumber community which produces only rough lumber has not to exceed 8 year-round workers for each million board feet of timber cut. The more permanent type of community in which forest products are carried through advanced stages of manufacture to finished lumber, paper, plywood, etc., may have 20 or more year-round workers per million board feet of timber cut. The drain on the forest is the same in both cases.

Timber Salvage

A supplemental appropriation provided funds for the coming fiscal year for the salvage of windthrown, fire-killed and insect-damaged timber in the States of California, Oregon, and Washington. Threatened losses through deterioration of dead and damaged timber will be greatly lessened by this special salvage program. In addition, the dire threat of infinitely greater losses from insects which develop in damaged timber and spread to and kill healthy trees is being abated by this program but will continue for several years. This critical problem came as an aftermath of forest fires and unusually severe windstorms in the summer and winter of 1951. The only known control measure is to cut and utilize the dead

JOBS DEPENDENT ON FORESTRY

MAN-YEARS PER MILLION BOARD FEET OF TIMBER CUT ANNUALLY



and dying timber thereby removing the source material in which the beetle infestation develops to epidemic proportions.

Access Roads

Long-term road agreements between the Bureau and the owners of private forest lands intermingled with O. and C. lands are now being negotiated. Two long-term "detailed" road agreements and 166 "arbitration" type agreements for varying periods of time have been concluded. Under such agreements the owners of private lands build roads to reach their own lands and unavoidably cross the O. and C. lands, thus making Government timber more accessible. Under road use agreements, construction and maintenance costs are amortized by prorating charges for use of such roads against the Government and private timber in proportion to the timber volume in each ownership. According to a development plan covering a definite term of years, the private owner builds the road system and the Bureau commits a certain volume of timber to come out over the road and agrees to offer it for sale over a stated term of years, within the allowable sustained-yield rate of cutting. Government timber is sold at oral auction in open competition. If the cooperator does not desire to pay the competitive price, he must make his road system available to the successful bidder. When this happens, the purchaser must pay toll for use of the road to the road builder at the rates specified in the agreement or at rates determined through prescribed arbitration procedures. Long-term road agreements of this character impose no obligation on the private owner to practice sustained-yield forest management, but do facilitate such management for those who wish to follow such practices.

The access problem also is being met in part through the construction of timber access roads with appropriated funds. Private timber transported over such Government roads is required to pay toll to reimburse the Treasury for a proportionate share of the road cost. Prices charged for Government timber are adjusted so that it bears its proportionate share of the cost.

Sustained-Yield Forest Management

In 1937 when management of the O. and C. lands was authorized, there was need of a good industrial-scale demonstration to show that sustained-yield management of forests could be made to pay financially. In general, the industry was skeptical and had to be shown that instead of being a luxury, sound forestry practices are not only necessary but profitable. The O. and C. lands are serving this purpose admirably.

The financial record of 13 years' management shows gross income from the lands of $32,089,159.77 compared with costs of management and protection of $4,630,970.00—a successful and practical demonstration that forest management is good business. Industry and other public agencies have watched the project with a great deal of interest.

This financial success of the management program on the O. and C. lands has focused attention upon the question of what constitutes a fair and proper rate of payment to local government to compensate for the fact that Government lands are not subject to direct taxation.

The Department has recommended a plan which would give the counties 50 percent of the net income. This would mean that the counties and the Federal Government would get equal shares of the net income after meeting all costs of protection, development and administration. This plan would facilitate the appropriation of funds for capital improvements such as roads and reforestation which are essential for realizing the full income-producing potential of these lands.

Because of lack of funds for administrative personnel and access roads, it has been possible to market annually only about half of the allowable sustained yield from the O. and C. lands. Approximately 400 million board feet of timber have been cut per year whereas 900 million board feet could be cut and probably should be, in order to develop and maintain the proper balance between young, old and intermediate age classes of timber in the growing stock. If and when it becomes possible to build up the program to the sustained-yield level, financial returns of this project will become even more favorable than in the past not only for the Government but for the counties as well.

Major Problems of Forestry Program

Considering that the oldest part of the Bureau's forestry program started only 15 years ago, accomplishments to date are very significant. However, important problems must yet be solved. Inventories are needed to determine the extent and location of public forest lands and the basic data regarding their resources which are prerequisite for sound management plans. The problem of translating data, policies, plans, and programs into readily comprehensible terms for the Congress and the general public, remains. There is need for up-to-date cadastral surveys to stabilize land tenure and to keep current and usable ownership status information. The reservation, development and management of recreational resources require attention. Questions regarding payments to States and counties in lieu of taxes must be resolved for other public lands as well as the O. and C.

lands. And, of course, there is the important problem of finding recruiting, training and retaining qualified personnel, and equipping them with the right tools to carry out the forestry program with efficiency and dispatch.

Protection of Forest Resources

Adequate protection from damage by destructive agencies—fire insects, and disease—is prerequisite to successful management of our natural resources.

Fire control.—Continued protection from fire of the 400 million acres of public domain in the United States and Alaska, although below an acceptable standard, is being steadily improved. Because of lack of funds, close cooperation with other agencies, Federal, State, county, and private, has been urgently necessary in order to have a more acceptable standard of protection on grazing districts. To this end additional cooperative agreements were entered into between Bureau of Land Management grazing districts and local communities in New Mexico and Arizona and cooperative agreements between the Forest Service and three Bureau of Land Management regions were revised to allow more flexibility in meeting the objectives of fire control in areas where lands of the two Bureaus are adjacent or intermingled.

Contract protection was continued on public domain situated too far from organized fire control units of the Bureau of Land Management to permit economical protection directly by this Bureau. Such areas aggregate 3,600,000 acres of commercial forests, woodlands, and grazing lands in the States of California, Idaho, Oregon, Montana, Washington, Arkansas, and Minnesota. In addition, the protection of 2,100,000 acres of Bureau of Land Management lands in western Oregon bearing high-value stands of Douglas fir timber, was contracted to the State of Oregon, State protective associations and the Forest Service. As a result of heavy fire losses sustained on O. and C. lands in 1951, protection contract and timber sale contract stipulations were tightened to overcome defects which may have contributed to such losses.

Improvement of the fire control organization was accomplished by the addition of permanent personnel in the high fire-hazard grazing districts in Nevada and southern Idaho. Very high frequency (VHF) radio, which permits noise-free transmission in spite of high electrical interference common during periods of high fire danger, was installed in two regions. Plans are under development in the other regions to replace all obsolete medium frequency sets with VHF as rapidly as funds are made available. Additional high pressure pumpers mounted on 4-wheel drive trucks were purchased by western regions in the States for fire suppression. These units have proven so satisfactory in the reduction of acreage burned and in the low manpower requirements that they have been adopted as standard suppression equipment. Two additional airplanes were purchased in Alaska at the close of fiscal year 1951, making a total of three Bureau-owned planes in that vast region. Planes were used very effectively in detection and scouting of fires and for air-to-ground contact by radio to guide and increase the efficiency of suppression crews on fires. Aerial cargo dropping has been adopted for dropping tools, equipment and food supplies to men on the fire line.

Disease control.—Disease prevention and control in commercial timber stands are essential to the production of quality timber. This is especially true with the present high demands placed on timber to meet the future needs of the expanded housing programs and defense requirements of the Nation.

White pine blister rust, a disease common to five-needle pines, requires two host plants, white pine (sugar pine, eastern and western white pine) and plants of the genus *Ribes* (currants and gooseberries). It can be controlled by destruction of the Ribes hosts. Eradication of Ribes on Bureau of Land Management lands in western Oregon was started in 1942 on an estimated total area of 150,000 acres of commercial sugar pine. During the last calendar year, 4,818 acres of Bureau of Land Management lands and 4,193 acres of National Forest, State, private and county lands were treated with initial eradication and 1,329 acres with reeradication.

Insect control.—Although not as spectacular as forest fires, annual insect damage exceeds that of fire, taking a heavy toll of timber stands each year. Insect infestations are difficult to detect in their early stages and oftentimes reach epidemic proportions before control measures can be started.

In the Douglas fir region of western Oregon, California, and Washington, the Douglas fir bark beetle infestation has been steadily gaining ground in recent years, has been intensified by the millions of board feet of timber killed by 1951 fires and millions more blown down by high winds in 1951 and early 1952. This fire-killed and blowdown timber scattered over millions of acres, including a very large acreage of Bureau of Land Management lands, is a natural breeding ground for beetles.

A cooperative survey to determine the extent and severity of the beetle infestation is now being conducted by Federal, State, county and private agencies. Salvage operations on Bureau of Land Management lands are being carried on as rapidly as possible through timber sales which will effect the removal of as much as possible of the fire-killed and windthrown timber before the beetles emerge in their flying stage next spring.

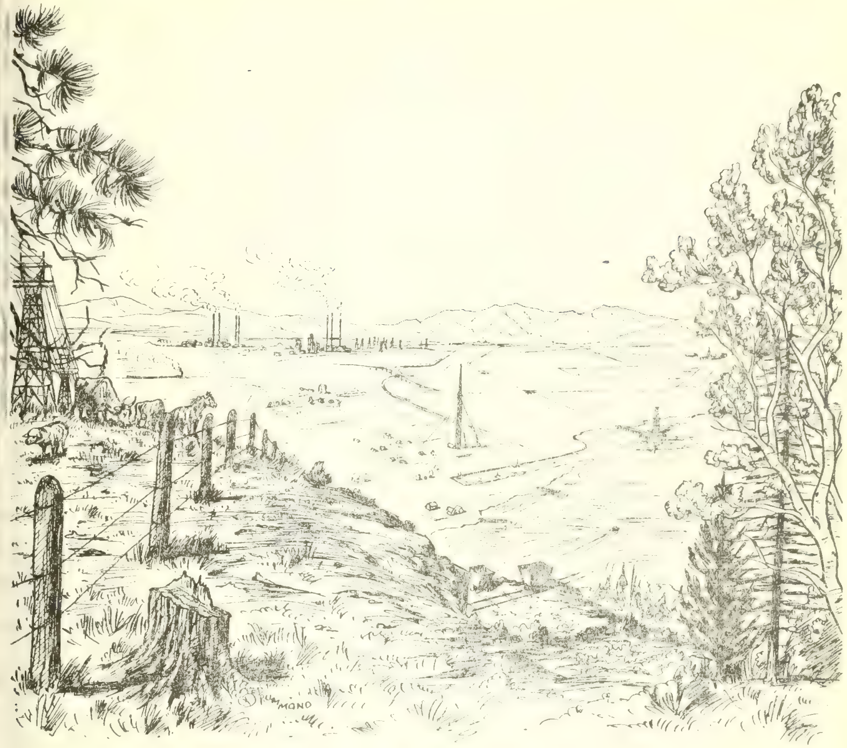
The spruce budworm infestation in the Douglas fir forests of Oregon and Washington which built up to epidemic proportions in 1949 has been brought under control. The 1952 control program completed treatment on approximately 1,000 acres of Bureau of Land Management land adjacent to and intermingled with lands of other agencies in the Blue Mountains of eastern Oregon and Washington.

PUBLIC LANDS IN GREAT DEMAND

The impact of defense requirements for national resources and of a booming civilian economy on the Bureau's land use and disposal activities has been particularly sharp because the Bureau's lands in large measure are located in or tributary to those parts of the Nation enjoying the most rapid population growth and unprecedented economic development. Thus the Bureau is faced not only with the need to meet its share of ever-rising defense requirements, but must also provide its share towards satisfying local living room and other needs. Complicating the Bureau's problems is the fact that it is called upon to supply in these same areas large tracts of land for important defense installations.

Illustrative of the situation is the city of Anchorage, Alaska. This "frontier" community during the past year realized a population increase of 5,000 persons, a sensational increase for that part of the world. This growth, combined with defense activities, has created intense demand for lands not only for residential but also for commercial and industrial purposes. In order to meet some of the needs, the Bureau has made available lands in the East and Fourth additions to Anchorage as a basis for the first industrial and commercial area in that community. Further development of Anchorage, however, is seriously handicapped, owing to the fact that the present city is virtually hemmed in by military installations. Adjustment of this situation is one of the Bureau's continuing land-use problems.

The story of Anchorage is being repeated, with variations and in different degrees of intensity, in other parts of the Nation. Uranium development in Colorado has created demands for residential areas. High demand for food and fibers, together with innovations in groundwater-development techniques, has generated a rush for desert lands. Flourishing economic activity has intensified the need for outdoor recreation, including the enjoyment of individually held sites in the desert and the mountains. Industrial and mining developments have insinuated new requirements which must be met from existing resources.



Our Public Lands have many uses.

Application Increase

In the more prosaic terms of day-to-day work, all this activity is reflected in an increased number of applications for lands and of conflicts among competing claimants for land. New applications requiring adjudication jumped from 12,900 in 1951 to 16,700 in 1952 while cases requiring field examinations increased from 7,500 in 1951 to 8,500 in 1952. Efforts to control the increasing workload during the year were multilateral and included (1) reorganization of the land-case adjudication function (2) decentralization of field examinations to area offices (3) emphasis on area classifications as compared to individual-case examinations (4) intensification of cooperative activities, and (5) more detailed program planning.

Division of Lands Formed

Consistent with the realignment of the adjudication function of the Bureau, the responsibilities for determination of the highest and best uses of the Bureau's lands (classification) and those for processing the papers to accomplish such uses (adjudication) were combine during the year in the Division of Lands. Unification of this activit has facilitated the execution of land policies by tying together closel the translation of the findings as to land capabilities to subsequen land uses through the medium of homesteads, exchanges, public sales withdrawals and reservations, and other devices.

During the year the Bureau took great strides in transferring majo responsibility for land examinations to its area officers. Not only ar such officers already on the ground, thus expediting the work involved but also they are in the position to be the most familiar with all th competing demands for the lands and resources of their particula districts. Concentration of examination responsibilities in thei hands is yielding much data needed for determination of the mos economic use of Bureau resources.

Area Studies

Concurrent with the decentralization effort is the Bureau's drive fo land examinations on an area basis rather than the case approach Area examinations permit an economic study of an entire locality an the consideration of all economic factors. This permits the balancing of all availabilities and potential uses against all needs and competing demands. It permits also the rapid disposition of cases upon completion of the study. During the year area studies were conducted in many areas of the West and Alaska, including, among others, Las Vegas, Pahrump, Mesquite, and Pinto Valleys in region II; Snowville, Iron County, Diamond Mountain, Monticello, and Dove Creek areas in region IV; Mimbres Valley and Lindrith area in region V; and various areas in region VII eliminated from national forests. The central problems in each of these areas may vary (dry-land farming in one, recreational sites in another, underground water supplies in yet another) but all are susceptible to small-area techniques.

Basin Studies

Basin-wide studies are proceeding apace in the Missouri River Basin and the Arkansas-Red-White River Basins. During the year the Bureau examined and classified 1,300,000 acres in the former and 218,000 acres in the latter. Basin studies are the ultimate in area investigations and provide the information for a positive, directed program of land use and disposal.

Since the volume of natural resources is limited, cooperation among the various Federal agencies and with State agencies is essential to the realization of optimum values from existing resources and the expeditious processing of land matters. During the year the Bureau intensified its policy of advocating and furthering cooperation among all land agencies. Besides its work on the various field committees, it actively promoted various projects designed to effect the proper and maximum use of the Nation's natural resources. Examples include cooperative efforts with Bureau of Reclamation to revoke unnecessary reclamation withdrawals and to provide proper administration of withdrawn lands; programs contemplating transfer of lands to various States for wildlife and recreational purposes; a new town site at Wallula, Wash., to replace the present site to be inundated by the McNary Reservoir; proposed development in conjunction with the State of Oregon and Douglas County of the North Umpqua Recreational Area; proposed transfer to the Forest Service of 130,000 acres in Montana and North and South Dakota; exchanges to eliminate private holdings from Glacier National Park and Inyokern naval ordnance test station; proposed pilot area for conservation development involving Agriculture, Interior, and the board of supervisors of the Shell Valley Conservation District, Wyoming; and proposed transfer of Choctaw-Chickasaw lands to Oklahoma A. & M. An important cooperative effort, the study of the Lower Colorado River Basin, was brought near to completion during the year. Five Federal agencies, including BLM, and three State agencies are cooperating in this project.

Need for Intensified Program Planning

The myriad of economic influences affecting land use can be considered in an orderly fashion only by careful program planning. During the year the Bureau was able to make some gains in its detailed planning. Its contributions to the 6-year programs of the various field committees reflected this progress. However, vast amounts of work have to be done before the Bureau's plans can be considered fully adequate for the task before it. A primary drawback to more rapid accomplishment is the great mass of basic data which are required in this new area of intense land use and conservation for the present and future.

1952 was thus a year of accomplishment in land classification and disposal with important advances in techniques and programs. Many individual accomplishments could be cited ranging from the opening of the Kenai lands in Alaska to settlement to the completion of the State of New Mexico—Forest Service exchanges in the Southwest. Another notable achievement was the completion of the Alaska Withdrawal Atlas. The atlas shows, in place, all withdrawals and reservations in the Territory, providing for the first time a basic record to support an orderly and sorely needed review of the withdrawal situation in the Territory. A different but likewise important piece of finished business was the completion of the examination and listing of the remaining tracts of unreserved public domain in the States of Nebraska and North Dakota. The lists have been circulated among interested Federal and State agencies to secure statements of their interest in individual tracts. Upon receipt of these statements, action will be taken to transfer the lands to their highest and best use.

In total, the Bureau examined and classified 1,514,000 acres via its Basin studies and 996,000 acres via small area and individual case studies. For small-tract purposes, a total of 13,246 acres were classified. Adjudication resulted in the closing of 17,400 cases and patents were issued for 374,000 acres.

The year's record, however, was not entirely one of accomplishment. Despite the efforts made, the Bureau could not outstrip the rush of new work and ended the year with an increased number of individual applications on hand. Many area studies, notably that of the Rogue River Basin in Oregon, had to be deferred for lack of time and personnel. Large areas of important work, such as investigation of occupancy trespasses and legalization of proper land uses, had to be largely delayed for similar reasons. Plans, however, were laid to tackle these problems at the earliest possible opportunity.

INCREASING DEMANDS FOR GRAZING RESOURCES

Population forecasts of the United States indicate a continuing upward trend approaching an over-all increase of about 25 percent by 1975. The shift in population from east to west is expected to continue, bringing the increase in population in west coastal States to possibly 45 percent or more. Corresponding increases in demands for foodstuffs, fiber, and other products are inevitable. The demand for beef, lamb, and wool is likely to become particularly acute unless production of these items in the 11 Western States keeps pace with the greater and greater consumption in the West Coast area.

In the past the public ranges now administered by the Bureau of Land Management have been forced to provide much of the additional forage required of an expanding livestock economy such as is now predicted. This additional and excessive grazing use during the past several decades was made at the expense of depleting the forage and soil resources of these ranges. Today these ranges in their present condition are fully utilized. Proper management to insure the maximum production of forage on a safe, sustained-yield basis precludes any increases in grazing use unless the production of usable forage supplies can be improved. There is no doubt that much improvement is possible but only through prudent grazing management and a greatly expanded revegetation, conservation and range improvement program. Such a program extending over 20 years now in the planning stage, is expected to increase the usable forage production on the public lands by about 30 percent at an overall cost of approximately $450,000,000.

Grazing Administration

This look into the future emphasizes the great importance of the forage resources on the public lands in supporting the economy of the Western States, the need for husbanding these resources, and the requirement for wise management and development.

Improved staffing during the past year has resulted in more intensive management and supervision of the Federal range and its uses. This fact is reflected in part by the greatly increased number of grazing trespasses detected and stopped. Many potential trespasses were prevented by the expansion of feed lot counts. Range resource inventories and surveys of dependent ranch properties were initiated in all regions. As an example, approximately 300,000 acres in the Idaho-Oregon region were inventoried. The information gathered in these surveys is essential to the adjudication of grazing privileges, the issuance and renewal of term permits, the subdivision of the range into small group and individual allotments, and the perfection of range management plans.

During 1952, permits and licenses were issued to 19,692 operators to graze 8,672,811 head of livestock on the public lands in grazing districts. Included were 2,409,395 cattle, 62,924 horses, 6,185,499 sheep, and 14,993 goats. Of the above operators, 8,120 are holders of ten-year permits.

As of June 30, 1952, 16,518,185 acres of vacant public lands outside of grazing districts were covered in grazing leases issued to 11,717 stockmen. This total represents an increase of 2,125,000 acres leased during this fiscal year over the total area under lease at the beginning of the year.

Range Conditions

The critical drought in the south half of California, Nevada, southern Utah, southwest Colorado, and nearly all of Arizona and New Mexico prevailed through the summer and late fall of 1951, requiring continued removal of livestock from the stricken areas. The first break in the drought occurred in the Arizona desert, which received rainfall during the winter reminiscent of the banner forage year of

1941. Rainfall also extended to other parts of the drought area resulting in range conditions showing a definite upward trend at the close of the fiscal year.

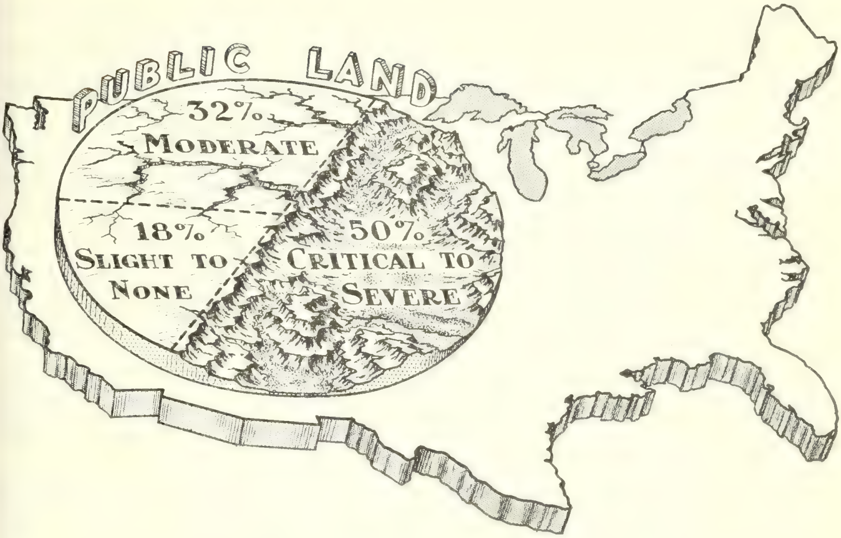
The northern ranges experienced a relatively dry summer and fall and a most rigorous winter with unusually heavy snowfall, particularly in February and March, and below average temperatures. Near catastrophic conditions developed in Nevada where unusually deep snows and blocked roads caused the Governor to declare an emergency. Deep snow and cold prevented grazing on most ranges throughout the Northern States and required heavy feeding of hay and concentrates far beyond the usual feeding period. The severity of conditions resulted in great hardship to livestock and big game. Deep snows, with unusually high water content, provided much needed soil moisture and when spring finally came range forage developed rapidly bringing about good to excellent conditions.

Wildlife Management

Wildlife populations on the public lands continue to increase permitting larger annual game harvests by sportsmen and the opening of new areas to hunting. The general improvement of range conditions and effective methods of predator control are primarily responsible for the increased numbers. Unusually heavy snows of the past winter caused some local losses of wildlife, especially deer in congested areas having limited amounts of winter range. It is anticipated that these losses will be overcome in part by favorable conditions prevailing this year. Upland game birds also have benefited from the generally favorable conditions on the range. The introduced Chukkar partridge, which has found a compatible environment on the Nevada rangelands, has now increased sufficiently to provide for more extensive hunting.

Cooperative Relationships

Because of the many and diverse interests in grazing lands, cooperation has become an important aspect of their administration. Well-developed and long-established lines of cooperation exist covering the management of interspersed lands of other ownerships, the management of wildlife resources and for a host of other purposes. During the past year, cooperation with State soil conservation districts was materially strengthened through the Bureau's participation in a program designed to accord public lands the same level of conservation treatment now available to private lands. This program, sponsored by the National Association of Soil Conservation District



Supervisors, provides for the selection in each of the Western States of a pilot soil conservation district embracing large areas of public lands to serve as a pattern area for the development of coordinated conservation plans by the land managing agencies concerned. Plans have been completed for districts in five States and are in progress in seven additional States.

Soil and Moisture Conservation

The growing need to coordinate the Bureau's soil conservation program with programs of the various river basin committees and other affected agencies, has prompted a major change in the programming of this activity. Needed conservation work is planned on the basis of complete watershed treatment of an entire watershed using a tributary or small watershed, wherever practicable, as the unit of work area. Priority of small watersheds scheduled for treatment is based upon the severity of the erosion conditions and the relative urgency for control measures. It is generally agreed among conservation authorities that the small watershed presents the best unit of land area for effective conservation planning and treatment.

Using the watershed approach during the past year, more than 600,000 acres of severely eroded public lands were treated with soil and moisture conserving practices. These will reduce accelerated soil erosion, flood runoff, and downstream sedimentation on the tributary watersheds of important western river basins. Increasing cooperation from public land users and others is evidence of the general acceptance of this program.

Halogeton Control

The Bureau's efforts to control this introduced poisonous weed were greatly facilitated during the past fiscal year by an appropriation to begin a large scale control program. Control plans have been coordinated with those of state and local agencies in order to achieve maximum effectiveness of the program. Cooperation from private and other owners of interspersed and bordering lands has been excellent. Private land owners particularly have made generous financial contributions to aid in the attack on this serious menace. Lack of basis information on the behavior and control of halogeton has been a handicap to the program. To alleviate this situation, the Bureau has entered into cooperative agreements with several western land grant colleges for the purpose of supporting control investigations now in progress. These colleges have been the principal source of information on which current control operations are based.

Climatic conditions of the past year have been unusually favorable for the spread and intensification of halogeton on rangelands. Likewise, such conditions have also been favorable for reseeding ranges to perennial grass, the most effective method of control. Reseeding operations have been initiated on 100,000 acres of infested rangeland which will be completed this fall during the proper sowing season. When established, these seedings not only eliminate and replace halogeton, but also provide grazing for livestock removed from other infested ranges. In addition to control reseedings, approximately 1,200 miles of roads and trails are receiving chemical treatment to check rapid long distance spread of halogeton. Surveys are under way on many thousands of acres of infested rangeland to determine the location of halogeton and to chart the best methods of control.

Range Improvement

Because of the drought conditions which had prevailed over many parts of the West up to the time of the spring runoff, emphasis in range improvements has been directed toward improving watering places for range livestock. These water developments, together with range fencing, have been the principal range improvements constructed during the year to facilitate better use and protection of rangelands.

The coordination and integration of planning range improvement and soil conservation work projects during the past year has increased operating efficiency and has resulted in more effective distribution of installations on the range.

CADASTRAL SURVEYING ACTIVITIES

Adequate cadastral surveys are a prerequisite to any comprehensive land management or development program. Definite boundaries must be established and corners marked on those boundaries before development of the resources of the land can proceed or the harvesting of such resources be accomplished. Land boundaries must be known before siol conservation and range improvement projects can be carried forward. The development of reclamation projects and the administration of the reclaimed lands are dependent upon adequate cadastral surveys.

In order to fulfill these basic requirements the cadastral survey program of the Bureau of Land Management for fiscal year 1952 was designed along lines that would lead most effectively to wider development of the natural resources and the improvement of our economic structure. The program was also influenced by the current defense situation with emphasis placed on requirements for surveys in areas having a high potential of strategic minerals, as well as in areas providing forage for the production of livestock and for production of timber.

Limitation of funds has made it necessary to screen the requests for surveys thoroughly. Priority determinations are decided by careful consideration of the immediate use and benefits provided by the survey and urgency of a project for development and management of the resources of the lands.

Surveys in the Continental United States

In the 11 Western States there are approximately 100 million acres of public domain over which the cadastral surveys have not extended. An additional area of approximately 50 million acres is in urgent need of resurveys due to obliteration of the monuments and other marks of the original surveys which were executed many years ago.

Title to approximately 50 percent of the area of the 11 Western States is still in the Federal Government. The extension of the rectangular net of surveys and completion of the necessary resurveys are basic to development and utilization of the natural resources in timber, minerals, grazing, etc. Those surveys are also necessary to satisfy school grants to the several States.

Cadastral survey projects completed during the past fiscal year encompassed the survey or resurvey of approximately 1,400,000 acres of land. The surveys included such essential work as the identification of lands for the Atomic Energy Commission in development of uranium deposits; the survey and resurvey of mineral lands for development of those resources, principally oil and gas; the survey and resurvey of forest areas to define the boundaries of timber management units and provide a basis for timber sales; and the survey of grazing lands for range improvements to increase the production of food. Also the program included the survey of approximately 3,800 small tracts providing homesites to meet the demand created by population growth in certain localities in Alabama, Arizona, California, Montana, Nevada, and Wyoming. The program also included the survey of islands, omitted areas, and accreted lands in Alabama, Florida, Louisiana, Michigan, Minnesota, New Mexico, North Dakota, Oklahoma, and Wisconsin.

Additional survey and resurvey projects were carried on by this Bureau to facilitate the land improvement activities of other Federal agencies such as the Bureau of Reclamation in the Missouri River and Big Thompson projects of that Bureau; the Bureau of Indian Affairs on several reservations in the Western States, including surveys in Oklahoma for exploration of minerals; and for the Department of the Army to define boundaries of military installations.

Surveys in Alaska

The lack of surveys is seriously retarding settlement and development of resources in Alaska. The Bureau's cadastral engineering program in that Territory must be accelerated to provide the necessary homesites, homesteads, trade and manufacturing sites, etc., required in the rapidly expanding development in that area. The identification and marking of the boundaries of the lands by cadastral survey is necessary in the administration of the many public land laws.

During the fiscal year the most urgent Alaskan projects were undertaken and many carried through to completion. This program resulted in the survey or resurvey of over 10,000 acres of land intended for agricultural development; the survey of 682 small tracts on which homes may be constructed; the survey of 483 town lots in rapidly expanding communities in that Territory; the survey of 151 group homesites and 27 individual homesites; 13 homesteads, 3 trade and manufacturing sites; 4 headquarters sites and other miscellaneous surveys. Eighteen miles of the center line of highway were traversed for the purpose of segregating the highway from the public domain and facilitating the administration of the adjoining lands.

EMPHASIS ON MINERALS

Continued upsurge and interest in exploitation, development, and conservation of mineral resources owned and controlled by the United

States was marked during fiscal year 1952. The importance of minerals to the economy of the Nation both in the interest of the defense program and the use of minerals as a means of increasing the standard of living in times of peace was emphasized when the Secretary of the Interior on November 12, 1951, created the Minerals Division as a principal segment in the Bureau's organizational set-up.

Functions of the Division of Minerals

The function of the Division of Minerals is to initiate, administer and develop programs for the use and disposition of federally owned and controlled minerals; to process the issuance of patents under the United States mining laws; to conduct the sale of minerals under the Materials Act and to classify and supervise mineral permits and leases. The Division coordinates and supervises land office operations of mineral resources; devices, installs, and directs uniform methods of procedure; prepares progressive personnel training procedures; reviews land office actions and prepares for the Director of the Bureau or the Secretary of the Interior, regulations and instructions in the processing of cases arising under the Mineral Leasing Act.

Oil and Gas Leases Top List

During the last fiscal year the oil and gas activities of the Bureau increased in great proportions due to the encouragement of a policy to find new sources of supply for this strategic mineral. During the fiscal year 1952, 32,000 oil and gas offers for leases were filed and 800 applications for other leasable minerals, such as potash, phosphate, coal, and sodium were filed. At the end of the fiscal year there were more than 63,000 oil and gas leases outstanding on the public domain, embracing over 48 million acres and 1,200 oil and gas leases outstanding on acquired land covering an area of over 1,100,000 acres. Four hundred fifty leases for other leasable minerals were outstanding embracing an area of over 220,000 acres.

During this period, 172 applications for patents on placer and lode claims made under the United States mining laws were filed, and 48 patents issued embracing about 5,000 acres. Due to the successful experimentation at Rifle, Colo., by the Bureau of Mines experimental plant to convert oil shale into petroleum products, it is anticipated that many hundreds of applications for patents on shale claims in the States of Colorado, Utah, and Wyoming will be filed in the near future.

Revenues Increase

The revenue from royalties, rentals, and filing fees under the Mineral Leasing Act increased materially during the fiscal year. Out of a total revenue of over $64,000,000 from various public land source activities, $51,000,000 of that amount was derived in bonuses, rental, and royalties from leases issued under the Mineral Leasing Act and the greater portion of that sum came from rentals, royalties, and bonuses under oil and gas leasing. In addition, more than $500,000 was received in filing fees.

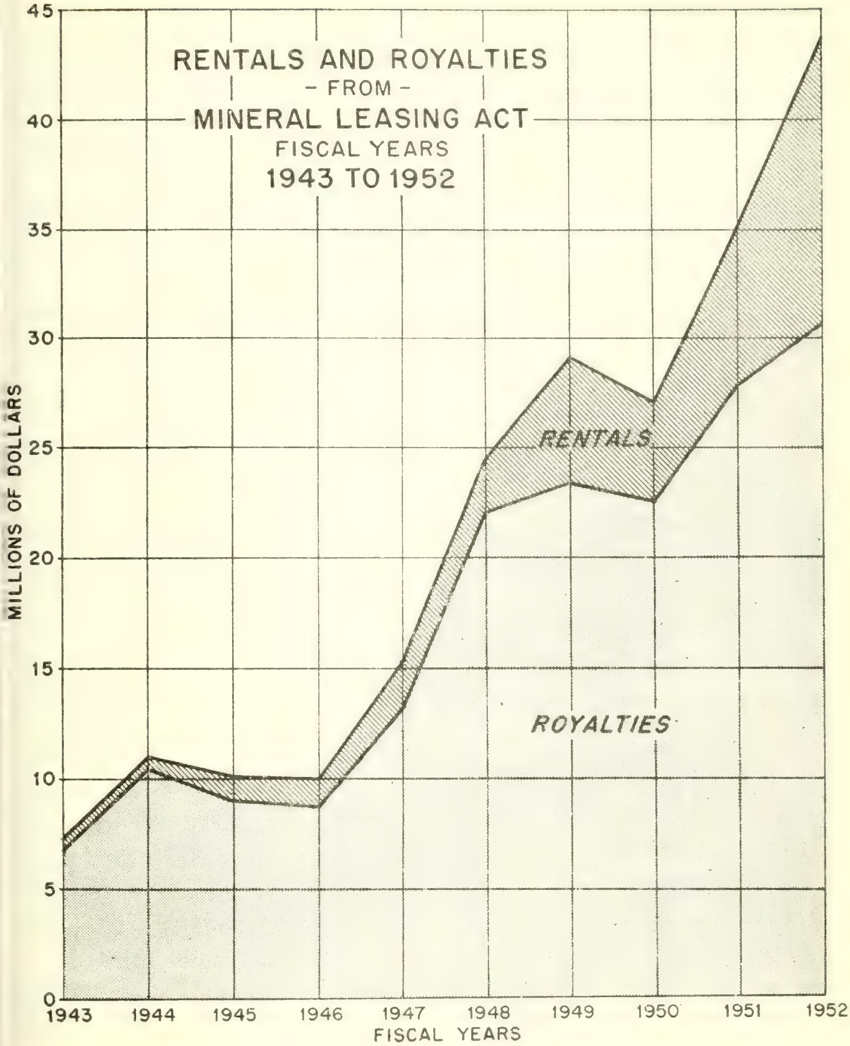
A summary of oil and gas leases issued competitively by States on lands within known structures of oil and gas fields follows:

State	Acres offered	Bids received	Total bonus offered
		Acres	
California	350.00	250.00	$13,697.25
Colorado	1,710.24	1,710.24	40,363.01
Kansas	240.09	240.09	3,502.90
Louisiana	283.83	283.83	21,251.88
Michigan	60.00	60.00	318.00
Mississippi	6.24	6.24	3,050.75
Montana	840.98	840.98	14,732.11
New Mexico	3,192.89	3,192.89	139,085.42
North Dakota	1,019.03	1,019.03	28,150.73
Oklahoma	27.50	27.50	1,238.21
Wyoming	1,624.17	1,624.17	61,341.70
Total	9,354.97	9,254.97	$326,731.96

Twenty-three coal leases were issued during the year, embracing approximately 7,500 acres, from which there was received bonuses of approximately $12,000. Approximately $4,750 was received as bonus from 4 competitive phosphate leases issued during the year embracing over 700 acres and 3 noncompetitive phosphate leases were issued embracing approximately 3,000 acres. Three preference right potassium leases were issued and 27 potassium and sodium prospecting permits for a total area of 53,000 acres. In addition, the total area of permits and leases issued for leaseable minerals such as coal, phosphate, potassium and sodium during the fiscal year was approximately 64,000 acres.

Steps Taken to Curb Speculation

During the fiscal year steps were taken to curb oil speculation in oil and gas leases, most of which involved newspaper and magazine advertisements offering the sale of oil and gas leases for 40-acre tracts for a consideration of from $100 to $300. Such practice not only swamped land offices with thousands of applications, but retarded the orderly exploration for oil and gas.



In order to curb oil speculation and protect legitimate operators, on June 17, 1952, the Secretary of the Interior issued an order limiting the issuance of oil and gas leases to areas of not less than 640 acres unless the lands applied for are within an approved plan of operation or in a unit plan approved as to form only or the surrounding lands applied for are not subject to oil and gas leasing. Studies have been and are being conducted to devise ways and means by regulation or legislation to curb promiscuous exploitation of the oil and gas resources on the public domain.

LEGISLATION

The legislative program of the Bureau during the past fiscal year listed several important developments. The proposal of the Bureau that a joint legislative-executive commission be set up to study the revision of the public land laws, introduced as House Resolution 115, met with a favorable response from the House Committee on Interior and Insular Affairs. Although it took no action on the joint resolution, the House Committee obtained funds for a preliminary study of the need for a revision of the public land laws.

There has been recognition of other problem areas by the Congress. Hearings were held on bills relating to the "controverted lands" in the O. and C. area in Oregon. The Senate Committee reported out S. 539. The House committee held hearings on the companion bill H. R. 6662 and a brief on the legal issues was submitted. There is now pending in the Federal District Court of Oregon, a suit by Clackamas County, one of the O. and C. counties, against the Secretary of the Interior, and other officials for a declaration that the $5,000,000 fund produced by the controverted lands should be distributed to the land grant counties.

The House Committee on Interior and Insular Affairs, recognizing the abuses to which the mining law is now subject, reported out H. R. 8341 which would amend the Materials Act of 1947 so that sand, stone, gravel, pumice, pumicite and cinders would no longer be subject to location under the mining laws. This bill was passed by the House of Representatives but there was not sufficient time at the end of the Congress for the Senate to take action on it. Significant is the fact that the provisions of the bill for safeguarding the making of bona fide mining locations were worked out with the active help of segments of the mining industry who have begun to recognize the abuses to which the mining laws are now subject. In this connection, on July 16, 1951, the Federal District Court of Idaho held that it would not enjoin a grazing licensee of the Bureau from grazing on the surface of a mining claim as against the mining claimant who wished to use the surface for grazing purposes unconnected with mining.

Again, the House committee took decisive action on H. R. 4752, a bill which would terminate the waiver of the second- and third-year rentals on noncompetitive oil and gas leases issued under section 17, the Mineral Leasing Act.

Regulations

The most important work in connection with issuance of regulations related to the mineral leasing activities of the Bureau. To counter the heavy influx of offers to lease land in 40 acre units resulting from advertising by promoters that they would obtain such leases at a $100 for each 40 acres, the Department issued a regulation which prohibited the filing of lease offers for less than 640 acres, except under special conditions.

In order to speed up development on leased public lands, provision was made for the use of a "Nation wide" oil and gas lease bond form which could cover all leases in one State, a number of States or the entire country of one lessee or operator. This elminates the necessity of filing bond on a particular lease before drilling may be undertaken. Since many assignments of record title are made in anticipation of drilling, a new "optional-use" form of assignment for such cases was devised. The simple one page form will speed up the approval of assignments and thus facilitate drilling. In addition, provision was made in the regulations to permit trustees for minors to acquire interests in oil and gas leases for their beneficiaries. On the other hand, provision was also made that agents who held powers of attorney, either upon the filing of a lease offer or thereafter, would have to submit statements as to the interest they held in such offers or leases. An amendment was made in connection with the issuance of phosphate leases limiting the overriding royalties that could be reserved. This is the same principle that has been applied to oil and gas leases and coal leases and is also being applied in the case of potash permits and leases.

There has been finally issued a set of regulations which combine former parts 244 and 245 into one part. It covers regulations for issuance of rights-of-way for all purposes in the United States other than railroad purposes and logging roads on the O. and C. lands. This consolidation has resulted in eliminating many unnecessary requirements. It has also pointed up, however, the necessity for revision of a mass of right-of-way laws now administered by the Bureau.

Other regulations have been issued to expedite the handling of work. In order to speed the issuance of mineral patents, after careful consideration of the legal problems involved, regulations were drafted making it unnecessary to have mineral patents contain a metes and bounds description of the area covered by the patent. Instead the patent will merely contain the mineral survey number. This should result in issuing patents much more quickly since they will be much shorter. In connection with the issuance of patents in Alaska a single form of patent was devised which would be suitable to cover all nonmineral cases in Alaska, provision being made by appropriate notation to cover the variations required by the different laws. Finally, the procedure required by regulations for holding drawings was amended so as to permit flexibility. This would eliminate repetition of the New Mexico drawing which involved over 20,000 applications and took several months to handle. It will make possible a streamlined procedure so that even that number of applications could be handled in a drawing in less than two hours after the opening time.

Litigation

The long controversy with El Paso Natural Gas Co. which had refused to sign the form of common carrier pipeline stipulation embodied in the regulations has been temporarily resolved. The company offered to file the stipulation providing it could accompany it with an agreement that the stipulation would not be binding if litigation over the right-of-way resulted in a holding that the Secretary lacked the power to require such stipulation. The two pending cases between El Paso and the Department have not been withdrawn nor have stipulations been filed in those cases. The company has been filing the required stipulations in all its other right-of-way cases. The first El Paso case was argued before the Court of Appeals for the District of Columbia before the end of the fiscal year but no decision has yet been rendered on it. The other case, as well as the one involving another company, are awaiting the Court of Appeals decision. On the question of the Secretary's authority to impose conditions in return for granting a right-of-way it is significant that in a suit pending in the District Court of the District of Columbia by the Idaho Power Co. against the Secretary it was held that the Secretary could require the company to enter into agreements to "wheel" public power for compensation over the company's lines as a condition precedent to the issuance of the right-of-way.

Litigation with the respect to the administration of grazing districts has resulted in clarifying some questions during the past year. The Circuit Court of Appeals for the Tenth Circuit in the case of *Chournos* v. *United States* held that actions taken by the Bureau of Land Management on applications for grazing privileges cannot be made the subject of suit under the Federal Tort Claims Act. In the case involving grazing trespass by some Navajo Indians in Utah the Court of Appeals for the Tenth Circuit reversed the judgment of the Federal District Court and remanded the case with instructions to reinstate the complaint of the United States against the Navajo Indians who had trespassed on the Federal Range. The lower court had taken the position that this was purely a matter for administrative action by the United States as the guardian of the Indians. Although the litigation has not yet come to trial another suit brought by white ranchers to enjoin trespassers by the same Navajo Indians on Federal grazing lands for which licenses had been issued to these ranchers and on State land leased to them resulted in the judgment by the State Supreme Court that the Navajos have no aboriginal rights outside of the established reservation.

Orders

Executive Order 10355 issued on May 26, 1952, streamlined the procedure for the issuance of public land orders by the Department. The Department can now issue public land orders without clearance with the Bureau of the Budget or the Attorney General. In addition, the Secretary is authorized to issue rules and regulations governing requests for and the making of withdrawals. This will make unnecessary the issuance of withdrawals prior to a hearing, and at the same time will protect lands needed for withdrawals from mining locations pending a final determination on the request.

Further authority was delegated to the Bureau from the Department by amendments to departmental order 2583 and in turn the Director by amendments to Bureau order 427 made further delegations of authority to the regional administrators. Significant among these was the handling of private exchanges which require, as in the color of title cases also delegated, the approval of title by regional counsel. Subsequently, the Department approved redelegation orders by regional administrators to their field offices, so that at the present time the widest possible delegation has been made in the handling of the greatest volume of work of the Bureau. In connection with the establishment of a forestry office at Russellville, Arkansas, in region VI a redelegation order was issued which contained the novel provision authorizing the district forester to reject any application filed with him for lands covered by a withdrawal. There has been made a withdrawal for over a 100,000 acres of land in northern Arkansas while consideration is being given as to its utility for forest management under the Sustained Yield Act of 1944.

ADMINISTRATIVE IMPROVEMENTS

Major improvements of the Bureau of Land Management were noted in each of the several branches of administration.

Fiscal Procedures

Continued improvement has been made in the field of fiscal operations. During the year, manuals were released for the operations in land offices and area offices, and billing and receipt forms were redesigned. Receipts issued in land offices at the time an application is signed provide sufficient copies so that one may be used as an accounting advice, indicating the action taken on the application and directing the distribution of moneys filed with the application. Since these receipts are prenumbered they are readily identified, and as pertinent information appears on all copies at the time of initial preparation, there is little left for the adjudicator to do other than to check certain blocks, and in cases of a varied disposition of money, to insert the applicable amounts. Both the billing and receipt forms are prepared with "one-time carbon" so that a considerable amount of clerical time is saved in making carbon copies.

Authority for certifying vouchers to process transfers and refunds has been delegated to the managers of the land offices, a procedure which eliminated previous delays in accumulating sufficient refunds to warrant processing them through the regional offices.

The reconstruction of all land office accounts was completed during the year, and all are now on a current basis. At the end of the fiscal year, the internal audit staff embarked on its first audit of current operations, that of the central office and region 6, both located in Washington.

The over-all simplification and streamlining of accounting operations permitted the Bureau to handle collections of about $64.5 million, an increase of over 78 percent over the receipts in fiscal 1950. Expenditures, likewise, increased over 50 percent during the same period.

During the fiscal year 1953 it is planned to decentralize the general ledger to the field so that each region will be in a position to fully analyze its operations. In decentralizing the general ledger, the records will be maintained on an accrued cost basis rather than on an obligation basis. This will reveal the cost of operations during the fiscal year in which the supplies and services are used rather than in the year in which the order is placed.

Records Management

Substantial progress was made on the Bureau's records management program during the past fiscal year. The completion of the microfilming project involving approximately 6½ million land patents together with the original survey plats of 22 out of the 29 public land States, was accomplished.

The program for revising the system of maintaining basic land records materially progressed during the year. A detailed record plan formulated by the Bureau was submitted for review to Bureau of Land Management officials and to others dealing in public land and similar records. Careful coordinated planning is extremely important because of the value of these records and the apparent large cost involved in making any revision.

Over 160,000 actions were taken in answering requests for public land information in addition to furnishing 52,234 photostatic copies of the Bureau's official records.

Administrative Services

Continued improvement of administrative handling of property, supplies and equipment by forecasting Bureau requirements and scheduling of procurement more closely received increased emphasis during the 1952 fiscal year. Property utilization and disposal of excess personal property has been particularly stressed, resulting in an increase in intra-regional transfers of property and the disposal of equipment to other agencies and educational institutions at a value of $62,496.60 during the year. In completing other property transactions the Bureau acquired personal property valued at $10,802.56 from other agencies. Regions 1 and 2 have taken particular advantage of excess property declarations and have acquired a number of excellent trailers to be used in surveys and fire emergencies. A number of military 6 by 6 vehicles were acquired and converted to truck-tractor use or as flat bed hauling vehicles. This has reduced hauling fees considerably in moving lug or track-equipped vehicles to operation sites.

By formulating an office equipment replacement schedule the Bureau has been able to schedule the acquisition of new equipment which has improved over-all operations and is gradually reducing maintenance costs. While the monetary savings can only be estimated, it is readily recognized that efficient untilization of property and equipment is a requisite for efficient and economical operation.

Management Planning

The management planning work of the Bureau continued to stress better and more efficient operations.

Incentive Awards

The incentive awards work of the Bureau continued as one of its important management tools. This work in accordance with a previous secretarial order has been centralized in one committee and combines the honor awards, suggestion awards, and cash awards and salary increases for inventions, superior accomplishments and savings. Under the new performance rating program of the Department responsibility for the review of "outstanding" ratings has also been placed in this Committee.

During the year the committee considered 105 new suggestions and 5 cases that were reopened, 14 recommendations for salary increase awards for superior accomplishments, and 12 recommendations for service honor awards. The committee approved suggestion awards in 20 cases out of 110, on which final report was made, resulting in an estimated savings to the Government of $9,165. Thirteen salary increases for superior accomplishment were approved for a total amount of $1,880, averaging $145 per employee. Three meritorious service awards and six commendable service honor awards were approved. In addition the committee considered seven recommendations for outstanding efficiency performance and approved four of these.

Management Improvement

The management improvement program of the Bureau promulgated in accordance with Public Law 429, Eighty-first Congress and Executive Order 10072, continued and was given special emphasis. This program, which has the active personal interest of the Director and all other top management personnel is active in all seven regions as well as the headquarters office in Washington. Problems are identified by all the various review and appraisal techniques, including scheduled reports, scheduled inspection surveys, staff conferences, as well as the suggestion system referred to above. These problems are then established as management projects with the branch of management planning responsible for the proper follow-through to their solution. This program also embodies the forms control, regulations control, and procedures control which is under the jurisdiction of this branch and which are effective management tools, and which during the past year have been responsible for many of the improvements made in regulations, procedures and methods.

Perhaps the most important accomplishment in management improvement during the year was the progress made on the new Bureau manual, which, when completed, will contain all the procedures, rules and regulations covering all the operations of the Bureau for the guidance of its personnel. Working with the old manual which in large respect is obsolete, has been one of the most difficult management problems. The first releases in the new manual were those covering the new fiscal procedures for the land and area administration offices which made it possible to decentralize the tremendous account job of the Bureau from the regional to the district offices. The benefits of this decentralization have already been remarkable.

Another important step taken in this program during the past year was the publication of the Bureau's Management Notes, an administrative report, which brings to the attention of all personnel major items in the management field.

The management improvement program has for the most part resulted in 50 revisions and amendments in regulations, procedures, and methods, giving the Bureau increased efficiency with less or the same manpower. Most of these changes usually are reflected in greater efficiency in paper-processing workload which rose from 45,753 cases in 1951 to 67,264 in 1952. This covers all applications filed for the use and disposal of the public domain or some of the resources under the Bureau's jurisdiction. Obviously, the paper-processing function is the type of operation where it is most easy to identify results from a management improvement program. Improvements in this field give supervisory and other personnel more time for perhaps the most important job of planning and programming.

Personnel

An important factor in the Bureau's efforts to strengthen its personnel management program and to obtain maximum utilization of employee skills was the development of written performance standards in connection with the performance rating plan. While this program involved considerable work on the part of employees and supervisors it is felt that the results will prove worthwhile in the improvement of supervisor-employee relations and hence give to the Bureau a better individual performance than would have been otherwise possible.

Management Training Program

The Bureau accelerated its participation in the management training program of the Department by arranging to employ at least one JMA in each of the seven regions and three in the Washington office. The need for bringing into the organization highly qualified generalists who are trained in public administration to work with experienced professionals in the fields of forestry, range management, agricultural economics, or engineering, is apparent in many levels and locations of the organization. The development of new employees and experienced employees in the management training program will do much to insure a reservoir of skilled personnel who can give leadership to the Bureau's programs in the years to come.

In line with the modern trend of placing in supervisors a greater realization of their responsibility for personnel management, a thorough analysis was made to determine whether appointing authority of field officers could be increased from its present limit of GS–7 positions and below. As a result a decision was made to redelegate to the regions authority to approve personnel actions of all kinds through GS–11 and below. This move will enable the Director's personnel organization to give more attention to essential staff functions and will bring to supervisors a greater appreciation of the importance of sound personnel management in accomplishing the objectives of their programs.

Squaw Butte Training Conference

The third Squaw Butte training conference was held in September with participation by approximately 40 Bureau employees and representatives from other Government and State agencies. Conferees were enthusiastic about the value that obtained from the 2-week-long conference.

Employees Number 1,310

Average employment of all types of employees except district grazing advisers was 1,310. Average employment in the Washington office was 208, and in the regions as follows: Region 1, 294; region 2, 160; region 3, 211; region 4, 180; region 5, 143; region 6, 24; and region 7, 90.

INTERNATIONAL COOPERATION

Interest in land problems and the activities of the Bureau of Land Management by other governments has been rapidly expanding in recent years. Greater recognition is being given in international programs to the fundamental importance of land policies for increasing production, raising standards of living, obtaining tenure security of individuals dependent upon land and other resources for a livelihood, and as a factor in stabilizing economic conditions and governments.

During fiscal year 1952 the Bureau of Land Management established an office of international cooperation on the Director's staff to meet the needs of expanding participation in the broad field of public land policy and programs. The work is conducted in close cooperation with international organizations and agencies of the United States and other governments. In operation, these activities are reflected in the United States position on foreign policy, international conferences, lectures at training centers, providing technical assistance to other countries upon request, using the Bureau's facilities to backstop its technicians on foreign assignments, and training nationals of other governments and their leaders through observation of the operating practices and results of the Bureau's domestic program. In addition, foreign scientists and administrators are becoming frequent visitors and a large demand is developing in other countries for information on the Bureau's activities.

The Bureau's participation in international activities involves all functions, including policies and procedures for the disposal and leasing of lands and minerals, assistance in establishing cadastral engineering survey systems and in handling technical survey problems, land use planning and land classification, land records, and methods of developing and managing grazing and forest resources. Essentially all of the underdeveloped countries of the world, in particular, are experiencing serious problems very similar in many respects to those which the United States has encountered in public land administration during some stage of its relatively short but rapid development period.

The Bureau of Land Management had representatives at international conferences in fiscal year 1952 and was represented on numerous departmental and interdepartmental committees dealing with international problems. A representative of the Bureau lectured at the FAO training center, which was held in Ankara, Turkey. In cooperation with the Technical Cooperation Administration of the Department of State and the Mutual Security Agency, 12 Bureau technicians were on foreign assignments working with the governments of Paraguay, Haiti, Egypt, Jordan, Iraq, Germany, and the Philippines. The advice and assistance which is being given to these countries is greatly appreciated by them and the Bureau is gaining in knowledge and perspective.

Negotiations are under way for providing additional technical assistance to some of these countries and to others. Action has been completed for bringing several technicians to the United States for training with the Bureau, and leaders to observe the Bureau's activities. The first group will arrive in September 1952.

REGIONAL HIGHLIGHTS

Because of the Bureau of Land Management's decentralized operations in its seven regions, highlights from regional reports are provided as an appropriate summary for this report.

Region I, Headquarters, Portland, Oregon

The year's activities have emphasized cooperation and teamwork. Visits to district offices by the regional administrator and divisional representatives have been reflected in closer liaison between the regional office and field offices. Short details of district personnel between the regional office, district offices, and Washington, have proved highly effective in promoting mutual understanding of operational problems and harmonious working relationships.

Reorganization of the Spokane land and survey office, to include all functions relating to land and survey, forest management, range management, field examinations, and miscellaneous land use, will prove conducive to improved area administration.

In consonance with the decentralized policy of the Bureau, transfer of functions in connection with accounts receivable and collections was effected to 19 field offices during the fiscal year.

The exigencies of the salvage situation and the corollary problems of access and right-of-way were assigned priority over other forestry activities during the last half of fiscal year 1952. Salvage of approximately 1 billion board feet of dead and dying timber must be effected, or a most serious economic loss will be sustained. The need for immediate action has been further emphasized by a beetle infestation of epidemic proportions, and by the concomitant risk of fire to the intermingled sound timber.

In cognizance of this problem, emphasis on timber sales has moved from areas of green timber to areas of salvage material, both in the 1952 and 1953 programing. In addition, the immediate salvaging of private timber has been facilitated by promulgation of an emergency access permit regulation, which was issued just before the end of the fiscal year.

Construction was initiated on the Quartzville Road, first access road project to be undertaken by the Bureau of Land Management.

In addition to providing access to some 8 billion board feet of hitherto inaccessible green timber, the access road program is being planned to accelerate removal of salvage in those areas where economic hauling of forest products is not now possible.

It is anticipated that a road into the Smith River area, where is located the worst blowdown will, when completed, tap 200–400 million board feet of salvage timber. Surveys on a major section of this road were completed during the 1952 fiscal year; construction is scheduled to start during fiscal year 1953.

During the year under review, 215 right-of-way permits were processed; 93 of the permittees signed reciprocal agreements, 63 being for periods of 10 years or more, with 27 extending perpetual rights to the United States. Several of these agreements were with major companies. Two detailed right-of-way agreements were completed and negotiations were advanced with several other major companies.

Receipts from O. and C. and C. B. W. R. timber exceeded $8,500,000 representing a 26.8 percent increase over any previous year. Income from public domain timber amounted to $736,000. The selling price obtained for both O. and C. and public domain timber, at $10,500,000 and $662,000, respectively, was the highest ever realized.

In the Vincent Creek Burn, aerial baiting of 11,944 acres to effect rodent control, and aerial seeding of 6,721 acres with Montana brown mustard seed to combat erosion and to provide protection to tree seedlings, was followed by aerial seeding of 5,441 acres with Douglas fir.

During fiscal year 1952, appropriations were for the first time authorized for the control of halogeton. A total of 62,000 acres was set up for range reseeding under S and M and halogeton control programs. Of this approximately 22,000 acres was completed; the remaining acreage is included in halogeton control contracts carried over for completion during 1953 fiscal year.

Meetings held with the South Idaho county commissions and representatives of the Idaho State Department of Agriculture have proved highly effective in developing cooperative relationships and coordinated programs for halogeton control. In addition, the Bureau should derive considerable benefit from a research program on halogeton control executed by the University of Idaho under terms of a cooperative agreement between the Bureau and the university.

A protracted dispute concerning privileges and range division was settled by a unanimous agreement signed by 29 operators in 2 units. This agreement constitutes a constructive and far reaching advance in the administration of Oregon-3 district.

Survey work was conducted on 15 projects in Oregon, Washington, and Idaho, all of which involved dependent resurveys and one minor extension survey. This work encompassed only those projects involving critical management problems and can hardly be described as significant in relation to the large volume of survey work that must be done in the interests of efficient land management.

The Division of Land Planning was reorganized into the Division of Lands and Minerals and assumed the adjudication functions formerly administered by separate division. Area management was strengthened by referring all cases to district offices for investigation or comment. Closer liaison was maintained with State and other Federal agencies to provide recreational, wildlife, or other public values.

Region II, Headquarters, San Francisco, Calif.

The division of administration in region II was reorganized following the establishment of a new position of regional administrative officer, and is now providing increased services to the various operating divisions. A clerks' conference was held in the regional office for the purpose of clarifying administrative procedures and actions used in field offices.

In adjudication the current figures and analysis show the region has held its own on the backlog of 7,000 cases and closed nearly 15,000.

In the line of area administration, region II opened an area office for northern California in Redding. This has brought administration and area classifiation closer to the local people which has resulted in settlement of long standing problems of mining claims versus small tracts.

The Region's halogeton control program has been of major importance in Nevada. Through regional efforts combined with cooperation secured from other Federal and State agencies, much eradication of this poisonous weed, combined with the region's reseeding program has converted a decided handicap to an asset of increased forage for the livestock permittees.

A program of increased cooperation with the Soil Conservation Service in joint administration of soil conservation districts in both California and Nevada and joint studies on pilot districts was carried on during the year.

Region II assisted materially in the second snow emergency program for Nevada livestock feeding.

The regional administrator acted as chairman of the Pacific Central Temporary Field Committee for the second year in formulation and coordination of the Interior agencies programs for California.

Wider and closer contacts with State public lands committee, other Federal, State, and business interests was emphasized. The local district program of public relations was materially improved resulting in increased recognition of importance of public land resources and BLM to local users.

The regional administrator participated in the International Land Tenure Conference at Madison, Wis., and following that served as adviser on land management to United States-Paraguay Joint Committee on Economic Development at Asuncion, Paraguay, under the State Department point 4 program.

Region III, Headquarters, Billings, Mont.

Increased demands for public lands resources and greater public realization of multiple use aspects of these lands are continuing and accelerating developments. The greatest impetus resulted from discovery of oil in the 8,000 square mile Williston Basin. The unprecedented rush for oil and gas leases still continues at a rate in excess of the region's processing capacity. Recreational uses, demands for wildlife and watershed aspects are requiring constant readjustments for more effective integration of public land use. To facilitate this program management and operational functions have been further delegated to area and district offices to give on the ground service to the public.

Increased land values and demand have resulted in the disposition through sales and exchanges of over 40,000 acres of isolated tracts unsuited for public use and management. To achieve more effective public land use management, nearly 10,000 acres of State-owned lands in Glacier Park are being exchanged for isolated tracts of public land in northern Montana. Other adjustments are being made through transfers.

Exchanges and withdrawals are in the mill to facilitate public programs of the States, Forest Service, Fish and Wildlife Service, Bureau of Reclamation and Corps of Engineers, when the public domain is essential to or can be most efficiently managed under programs of these public agencies. Many of these adjustments were effectuated pursuant to developments and findings in the Department's programs of investigation and development of the resources in the Missouri Basin.

Emphasis on range management was placed on maintaining forage resources in a healthy and vigorous condition and meeting the increased demand for range use insofar as possible.

There was a total decrease in volume of timber sold but an increase in the number of sales, which reflects better resource management. Fires were not serious, due primarily to favorable weather. A serious threat exists and severe loss is imminent if and when a dry year occurs. Improved facilities and organization for fire control is urgent.

High runoff and floods exerted severe tests on installed soil and moisture conservation structures. Some losses occurred but much valuable experience and hydrologic data were gained for developing and improving designs and application of watershed manipulation. Emphasis continued toward converting this storm water runoff from a destructive to a beneficial agent. Range use facilities and improvements were effectively integrated into comprehensive resource development plans.

Infestations of halogeton were found which extended to several thousand acres in the Wind River Basin. Control measures for the nearly 500,000 acres of known infestations are proceeding on the basis of preventing further spread and neutralizing infested areas through introduction of more effective competition of other desirable vegetation. This is being induced by reseeding, water spreading, and related moisture and conservation practices, and through appropriate range management. Unfortunately, control trials through chemical spraying were very discouraging.

Cadastral surveys or resurveys were completed for 835,470 acres most of which were to facilitate programs for reclamation and irrigation projects. Of this total, 281,140 were in Nebraska, 210,560 in South Dakota, 141,600 in Wyoming, 137,530 in Montana, 48,000 in Kansas, and 16,640 in North Dakota. Survey was made of 137 small tracts which were classified for home sites and business sites in the vicinity of Missoula, Mont., and Greybull, Wyo. Other survey projects of special interest included the marking of the boundary of the Grand Teton National Park.

Region IV, Headquarters, Salt Lake City, Utah

Mineral withdrawal mapping project for two States and project studies for clearing invalid claims from critical uranium areas were prepared in cooperation with AEC to expedite development of uranium resources needed in atomic energy production.

Oil shale project studies were completed for extensive deposits of this resource in Utah and Colorado.

The backlog of adjudication cases was reduced from 5,323 to 3,753. Adjudication cases in the Land Office are approximately current.

Program planning for the region was carried out through the Department of the Interior field committees which has resulted in better coordination of Departmental programs demonstrating the need for timing of programs for the orderly development and conservation of all resources.

Comprehensive classification surveys were carried out in the Arkansas Basin on 218,000 acres of public domain and in the North Platte of the Missouri Basin on 167,000 acres.

In the grazing administration, emphasis was placed on dependent property studies as a basis for equitable adjudication of grazing privileges to stabilize livestock operations and to arrive at proper management and stocking of the Federal range.

The beginning of a regularly scheduled administrative audit-inspection program of district offices by personnel from the regional division of administration was started. Excellent progress was made in tying together program plans with budget estimates in disposal or storage of many BLM obsolete records. There was a large increase in receipts in 1952 over 1951 without any appreciable increase in personnel. Another administrative highlight was bringing in balance the property inventories with property control records and fiscal control records.

Cadastral surveys in the region were completed on 241,016 acres largely in connection with Reclamation and AEC projects. In cadastral survey planning in connection with other Federal agencies, there is an increasing demand for cadastral surveys in connection with action programs of other Bureaus. The need for a direct appropriation to BML for cadastral surveys to accommodate action programs of other land management agencies has been emphasized.

Region V, Headquarters, Albuquerque, N. Mex.

The consummation of the State-forest exchanges, commonly known as application 2–21, disposed of a problem which has been pending before the Bureau and its predecessor agencies since 1932. The impasse which has existed for such a long time was overcome by changing the location of the selected lands in a manner that was advantageous to all parties concerned; the State, the Forest Service, and BLM.

Further progress has been realized in achieving the Bureau's objective of handling all activities possible at the field level. This area administration plan, inaugurated during the 1951 fiscal year, has necessitated a plan for adjustment of former grazing district boundaries and office locations, in order that each area of administration can justify a staff representing all or most of the Bureau's activities. One of the adjustments provided for in this plan (modification of New Mexico districts 2 and 4, and moving of office location from Magdalena to Socorro) was accomplished during the year.

Another outstanding achievement is publication of the Code of Ethics, a joint effort of the oil and gas industry, the livestock industry, USGS and BLM operations in the San Juan Basin of New Mexico. This Code is designed to eliminate conflicts between these two important uses of public lands; to provide a more amicable relationship between the two industries; and to minimize the surface damage to lands which usually accompanies oil and gas activities.

Following the close of school in June, region V started its first full scale trainee program. Five range management trainees and 14 soil and moisture trainees are learning certain phases of BLM work while at the same time giving worthwhile aid and assistance to these two programs in the field.

Effective soil and moisture conservation work programs were concentrated in the San Simon tributary of the Gila and in the Rio Puerco tributary of the Rio Grande. Both of these watersheds contribute damaging amounts of sediment to the San Carlos Reservoir in Arizona and the Elephant Butte Reservoir in New Mexico. Reducing the movement of soil from the watershed areas is providing for greater production from the public domain rangelands and is lessening the deposition of sediments in the river channels and water storage basins.

After detailed study and collaboration with appropriate State officials, the region has established a policy with respect to handling the several hundred desert land applications in Arizona. These entries, if allowed, would further tax an already critically depleted underground water supply, thereby placing in jeopardy a substantial segment of the agricultural economy of the State.

Worthy of mention as an accomplishment this year is the holding of a large oil and gas drawing involving 42,245 acres of public land in southeastern New Mexico, which was opened to leasing by the Secretary's order of October 16, 1951. Approximately 28,800 lease offers were handled in the drawing.

Region VI, Headquarters, Washington, D. C.

A most significant step taken in connection with the administration of public lands, within the jurisdiction of this region, was the withdrawal of some 112,000 acres of such lands on May 23, 1952, by Public Land Order 834, for the purpose of establishing a sustained-yield timber management program. The lands are located within 17 counties of the State of Arkansas.

A district forestry office, staffed with forestry personnel, was established at Russellville, Ark., to implement the objectives of the withdrawal. Timber sales made as a result of the above action, have brought higher prices under the first regulated, good forestry practice on public lands in that State. A distinct and substantial contribution to the resource economy of the area has been made through the program.

Additional benefits which will result are those involving the preparation of adequate timber and other resource inventory data and greater opportunities and facilities for cooperating with the Arkansas-White and Red River Basins inter-agency programs.

Considerable increase in the number of applications have been received and processed under the small tract laws principally for home sites, bringing to approximately 950 the number of such leases which are now outstanding. Recent discoveries of oil and gas on lands under the region's jurisdiction have substantially increased the number of oil and gas applications filed in and processed by the region.

Requests by various States have been received for large area acquisitions to be added to their conservation and recreation programs. Several Federal agencies have also presented requests for public lands in this region. The most active in this regard are the Forest Service and the defense agencies.

The region inaugurated and carried forth its first program for training of junior management assistant personnel.

Region VII, Headquarters, Anchorage, Alaska

Through a series of restoration orders signed by the Secretary of the Interior, the Bureau of Land Management in Alaska launched its first program of planned homestead settlement during the year. The land had been withdrawn for classification and after being studied by Soil Conservation Service and BLM specialists, a plan of establishment of farm units for portions of the area was adopted. Small tract groups were opened to entry, designation of industrial and commercial areas near the town of Kenai was completed, and certain lands were withdrawn for recreational purposes.

When the Forest Service relinquished about 29,000 acres of land in southeastern Alaska through Public Land Order 842, the Bureau of Land Management inherited more problems than had been handed region VII in one package since the creation of the region. Provision had to be made ahead of the establishment of the pulp mills for settlement. Classification men and survey parties were sent in while the land was still in the national forest, so months of time were gained but months of time remain before administration can be said to be running smoothly. Surveying, classification, timber sales and administration of recreational lands established by the Forest Service all offer a real challenge in that area.

Elsewhere in Alaska, the work load continues to build up too. The public sale act was put into active operation with practically all of the east addition and much of the fourth addition to the townsite of Anchorage an dareas along the Anchorage-Palmer Highway being sold. Thus an industrial and commercial area adjacent to the city of Anchorage is being created. However, the big flaw in the Act permitting mining claims on such lands has thrown much of the sale into doubtful status and BLM into court as gravel claims have been staked. A temporary restraining order against the claimants was obtained. A total of 63 lots brought a sale price of $73,425. Business under the Material Act particularly involving extraction of gravel from below mean high tide increased considerably, centering mainly in the vicinity of Ketchikan. A total of 115,914 cubic yards of gravel were sold throughout the Territory during the year and 2,680,500 yards were included in free-use permits for public purposes.

Timber sold amounted to 20.5 million board feet while free-use permits accounted for 2.1 million board feet. The number of inaccessible fires decreased considerably as BLM's zone of operations has been greatly extended due in great measure to air operations. An unprecedented number of patents were issued to Alaskans as 818 were processed through the Anchorage land office alone. In addition, more than 300 deeds to townsite lots were processed by the Division of Engineering and the townsite trustee. Aboriginal claims still held up issuance of oil and gas leases upon which largely depends the early proving or disproving that the Katalla area is an important oil producing area. Special attention was given by surveying crews to facilitate settlement on small units in congested areas such as small tracts selected by BLM homesites laid out by the Forest Service and townsite surveys of areas already occupied. Among the latter were Kotzebue, McGrath, and Aniak. It was necessary to traverse 18 miles of highway because of Public Land Order 601 in addition to surveying 483 townsite lots, 682 small tracts and 178 homesites, in special group surveys as well as 2,720 acres of original surveys and 7,680 acres of dependent resurveys under the rectangular system. The keeping of status on unsurveyed lands for the whole region is a Herculean task. Approximately 447 oil lease applications alone were platted and status prepared.

The trend toward land disposal in smaller units is illustrated by the issuance of 24 small tract classification orders which opened to lease 833 small tracts covering 2,000 acres. This attention to establishment of homesites primarily falls far short of meeting the demand as in most openings there are five or six times as many applicants as tracts available. The program therefore continues to be stressed. Thirty-five cases involving the leasing of 335,594 acres of grazing lands were closed. Inventory of grazing lands continues and only two large areas in southwestern Alaska where most of the Territory's potential grazing seems to be centered remain to be completed. Attention will then be turned to interior areas such as the Tanana and Nenana River Valleys.

The program for the study and restoration of unneeded shore space reserves continues as 16,000 acres of shore was put back into circulation during the year. The road building agencies in Alaska face serious problems in determining the legal width of rights-of-way. As the dates upon which claims were established are governing factors, BLM is generally involved in these discussions. The Alaska field committee, through a subcommittee on which the regional counsel serves, is making a study of the problem and will make recommendations at the next meeting of the field committee.

FISH AND WILDLIFE SERVICE

Albert M. Day, Director

The Fish and Wildlife Service continued its varied activities throughout the country and in the seas around the continent, for the conservation of our fish and wildlife resources, including promotion of better use of these resources; for the restoration of depleted but renewable resources; and for the management of those resources under Service control.

Search for new sources of fish for food, and research in fishery biology, have extended through the North and Middle Atlantic, the Gulf, Alaskan waters, Pacific-coast waters, and Hawaiian waters. Migratory-waterfowl research has extended from Alaska and Canada to South America. Wildlife refuges, fish hatcheries, and control of harmful species, have helped preserve and replenish our valuable living resources.

There has been progress in cooperation between Federal and State agencies and among Federal agencies, in the conservation and management of fish and wildlife. Addition of a fisheries-restoration program complementing the successful wildlife-restoration program, through Federal aid to State projects, is a notable step. Reorganization of the Service's law-enforcement and game-management activities has facilitated State-Service cooperation. There is closer cooperation with the States in planning the annual game regulations. Cooperation with other nations has been furthered.

UTILIZING THE FISHERY RESOURCES

Accomplishments in the fields of exploration, development, and utilization of the Nation's commercial fishery resources have been substantial and in considerable variety.

The Service's exploratory-fishing vessel *John N. Cobb* located seasonal commercial concentrations of shrimp along the Alaskan coast.

A deep-water survey off the Washington coast located several ne fishing areas to increase the catch of Pacific-coast bottom fish. Add tional exploratory work on albacore tuna is being carried out to dete mine the availability of these fish to the trolling fleet.

The vessel *Oregon* continued work on the Gulf of Mexico shrim program. The preliminary survey will be finished early in 195 Large schools of blackfin tuna have been observed during the summe months, indicating a potential fishing area in the Gulf.

A study of electronic aids for locating school fish has been starte on the Atlantic coast. Equipment is being purchased and installe on a chartered research vessel, the *Bowdoin*.

Promising results have been obtained from the New England blu fin tuna exploratory fishing survey. Large catches of choice 25- t 50-pound tuna, made with purse-seine gear last summer, have demo strated the good commercial potentialities. Further investigation are being carried out, with long-line gear and gill and trammel net

Exploration for little tuna, in cooperation with the industry, i South Atlantic coastal waters demonstrated that quantities of thi species occur there. Catching techniques must be given further attention before this resource can be utilized.

Commercial-scale tests of the new method of freezing whole fish a sea were carried out on the research trawler *Delaware*. Immediatel after being caught, the fish were frozen in brine for later thawing filleting, and refreezing of fillets ashore. Several lots of whole fis and fillets were prepared for commercial storage and for consumer acceptance tests. Other lots were sold to commercial fillet producer who will gain experience in handling and marketing the new produc in accordance with recommendations of the Service. Previous laboratory tests show the superiority of fish fillets prepared from whol fish frozen at sea over fillets from fish iced at sea in the normal commercial manner.

Commercial-scale test shipments of salmon trimmings were mad from Alaska to the State of Washington. The waste is an excellen source of protein and vitamins in the diet of hatchery fish. The newl developed packaging and handling methods proved satisfactory, an shipments were acceptable on regular commercial refrigerated vessel Cost records indicated that collection of salmon waste in Alaska fo use as fish-hatchery feed in Washington and nearby states is comme cially practical.

As required by the Fishery Cooperative Marketing Act of 193 numerous fishery cooperative marketing associations were visited an reported on. There were 69 active fishery cooperative marketing ass ciations in the United States in May 1952, compared to 73 in May 195

Typical of help given the fishery industries in transportation case and international trade problems were exhibits and testimony in Ex Parte 175 before the Interstate Commerce Commission to show the effect, on distribution of fishery products, of proposed changes in transportation rates and charges, and the information and assistance given domestic tuna and groundfish fillets interests on international-trade problems.

A fish and shellfish preference survey was conducted during the year. A report, Fish and Shellfish Preferences of Household Consumers—1951; Part I—National Summary, summarizes answers to questions about preferences and desires with respect to fresh and frozen fish and shellfish packaging, grading, cooking, cuts, and availability.

Seven Fishery Market News Service field offices, at Boston, New York, Hampton, New Orleans, San Pedro, Seattle, and Chicago, were operated in spite of increased costs. Full- and part-time marketing specialists in fishing and distribution centers gather current production and marketing data, which have become increasingly important to the fishery and allied industries. Although funds limit expansion of coverage, a start has been made in reporting weekly prices on canned and frozen fishery products.

Field offices continued to handle Defense Fisheries Administration field activities and act as liaison between the trade and DFA.

The monthly Commercial Fisheries Review featured articles on the fisheries, news of trends and developments in the fishery industries here and abroad, and Government orders affecting fisheries.

Market News data have been used as a basis for defense regulations and as evidence in a number of Tariff Commission and congressional hearings. Usefulness of the data collected over the past 15 years has increased.

Home economists of the Service conducted 134 fish-cookery demonstrations for school-lunch staffs and 26 special demonstrations for homemakers, institutional managers, and educational groups. Promotion of fishery products for school lunches was carried on in cooperation with nine States, and in some of these States increases of up to 80 percent in use of fish have resulted.

A program was started during the year to increase the sale and distribution of frozen fishery products through the 11,000 locker plants in the United States. After a preliminary campaign in Ohio, the campaign was expanded to other States.

The special monthly reports on the fishery supply situation and the quarterly market-outlook reports have been continued for the use and guidance of restaurants, food chains, fishery associations, and government organizations. The technical abstracting service on the commercial fisheries was continued on a monthly basis.

A contract for a motion picture on the shrimp industry was let but the shooting will not take place until the next fiscal year. The distribution of motion pictures through the 60 film libraries and their showing over television networks were continued.

General statistical surveys covering all sections of the United States having commercial fisheries of any importance were completed for the year 1950. Tabulation and publication of the results have been begun and are expected to be completed during the next fiscal year. Similar surveys covering the year 1951 were begun in all coastal areas, and arrangements were made to obtain catch data in the Great Lakes States for 1951.

Monthly and annual bulletins on the landings of fishery products in Maine and at the principal Massachusetts ports, and monthly bulletins on the landings in Florida, Mississippi, and Texas were continued. Publication of the monthly bulletin listing landings in Alabama was discontinued, as the Alabama Department of Conservation was unable to continue furnishing the necessary information. In cooperation with the New Jersey Department of Conservation and Economic Development, arrangements were made for the collection and publication of monthly data on landings of fish and shellfish in New Jersey.

Publication of monthly statistics on the freezings and holdings of fishery products, and on the production of fish meal and oil, was continued.

ADMINISTRATION OF ALASKA FISHERIES

Management of the Commercial Fisheries

Marine fishery conservation activities in Alaska during 1951 were administered by 22 permanent fishery-management biologists and enforcement agents, assisted by 10 agents on detail from the States. This supervisory staff was augmented by approximately 98 temporary seasonal patrol agents and stream guards employed by the Service, and 17 employees of the Territorial Fisheries Board. Eight seagoing patrol vessels, 11 speedboats, about 60 outboard-powered small craft, and 10 aircraft, were used in management and patrol activities. Nearly a quarter of a million miles were traveled by these various modes of transportation. There were 155 cases of violations of the fishery laws and regulations involving 350 individuals and 5 companies, 1 of which figured in 2 cases. The 5 companies and 248 individuals were found guilty, 85 individuals were acquitted, charges against 2 minors were dropped, cases against 3 individuals were dismissed, 5 cases were settled by confiscation of fish only, and cases involving 7 persons were pending at the end of the year. Fines, forfeitures of bonds, and sales of confiscated fish totaled over $73,000. Jail sentences of 1,890 days were imposed, of which 1,815 days were suspended.

The 50-percent escapement of brood salmon to the spawning waters, as required by statute, was assured by counting weirs in 14 major streams. This is a reduction of two weirs from the previous year, caused by high water preventing their installation. Five were installed in Southeastern Alaska, one in Prince William Sound and Cook Inlet, four in Kodiak, and three in Bristol Bay. The weirs also give precise information on time of arrival and duration of the runs of the several species. To obtain data on the hatch and survival of pink salmon of the previous year's spawning in Southeastern Alaska, seven downstream or migrant-sampling weirs were installed. More than 65 beaver dams and other obstructions were removed from spawning streams in the Cook Inlet region.

Pribilof Islands Fur-Seal Industry

Fur-seal skins taken on the Pribilof Islands in 1951 totaled 60,689, of which 50,573 were from St. Paul Island and 10,116 from St. George Island. This represents an increase over 1950 of only 485 skins. Of the 1951 production of sealskins, 20 percent was delivered to the Canadian Government under the terms of the Provisional Agreement of 1942. The byproducts plant on St. Paul Island produced 351 tons of fur-seal meal and 40,000 gallons of oil. One-half ton of meal was transferred to the Fur Animal Experimental Station of the Department of Agriculture at Petersburg, Alaska. The rest of the meal and the oil were sold through competitive bidding for the gross amount of $76,315.61. During the winter of 1950–51, 1,426 blue-fox pelts were taken on the Pribilof Islands.

Two public auction sales of fur-seal skins were held at St. Louis, Mo., during the fiscal year 1952. On September 24, 1951, were sold 25,031 fur-seal skins for the gross amount of $2,249,892. At the same sale, 550 Pribilof Islands blue-fox pelts brought $2,750. On April 7, 1952, were sold 22,008 sealskins for the gross sum of $1,788,630, and 350 blue-fox skins for $2,052. The sealskins were dressed, dyed, and finished in three shades, "Matara" (brown), "Safari" (brown), and black. A few sealskins were sold during the year for promotional purposes.

RESEARCH IN FISHERY BIOLOGY

Coastal Fisheries

Research in southeastern Alaska was concentrated on pink salmon. A 10-year study of the effect of temperature on survival of pink salmon in a test stream (Sashin Creek) indicates that warm water favors high survival and that temperatures in the latter part of the incubation period have a greater influence on survival than temperatures in the fall and early winter.

Studies of survival of eggs spawned in the intertidal zone showed virtually no survival to fry stages when salt water covered the nests 70 percent of the time, and good survival when it covered them 30 percent of the time or less.

Tag recoveries show that adult fish generally move toward their spawning creeks through Icy Strait, passing southward into Chatham Strait and then eastward into Frederick Sound and Stephens Passage; minor offshoots lead into Lynn Canal and South Chatham Strait.

Study of daily catches of pink salmon by traps is being made to determine changes in time of spawning migration and, if possible, to correlate these changes with biological and meteorological factors.

The Fisheries Research Institute of the University of Washington and the Service are carrying out a cooperative study of salmon in Cook Inlet, Alaska, to determine the destination of stocks of red salmon being intensively exploited by the relatively new gill-net fishery.

For preliminary appraisal of the effect of fertilization on growth and survival of young salmon, commercial nitrate and phosphate fertilizers were placed in a small lake on Kodiak Island. The growth of microscopic plants increased greatly. This program includes chemical analysis of lake water, studies of bottom fauna and plankton, and enumeration and measurement of young red salmon produced in the lake.

Work on the Alaska herring was limited to sampling the catch in major fishing areas to determine relative abundance and the age composition of the catch.

In accord with the plan originally agreed upon for the 6 years of shad research authorized by the Congress in 1949, work is concentrated on Chesapeake Bay (previous years' work was on the Connecticut, Hudson, and Delaware Rivers). Field operations include the tagging of 4,000 shad in the spring of 1952. Recoveries of tagged fish will permit estimation of the size of the runs, the rate of capture, and the migration routes. The shad-producing States of the Atlantic seaboard, through the Atlantic States Marine Fisheries Commission, are cooperating with the Service in this work.

Experiments with electricity, sound waves, light waves, and magnetic lines of force are being conducted to develop means of guiding adult salmon and other fishes over dams of Northwest streams to their breeding grounds and the young fish back to the sea. Distinct reactions of fish to pulsating direct current have been found.

Inland Fisheries

In a 3-year search for methods to control the sea lamprey in the Great Lakes, emphasis has shifted from mechanical to electrical devices. Although past researches demonstrated the usefulness of dams with traps, and weirs with traps, for controlling the lamprey, high construction and operation costs make less-expensive methods imperative. Experiments in 1951 with electrical devices showed that they can divert, trap, or destroy all adult lampreys migrating upstream to spawn. Electrical devices are being operated in six streams that differ greatly in volume, depth, and quality of water. Changes in these devices from time to time increase efficiency of design and reduce installation and operation costs. Since electrical devices sometimes inhibit migration of game fishes as well as lampreys, a means is being sought to lead desirable fishes into a shielded trap to speed their upstream passage.

That the length of the parasitic phase of the lamprey's life cycle in Lake Huron is 1 to 1½ years is confirmed by feeding experiments. These experiments have also made it possible to estimate the pounds of fish a lamprey destroys during its parasitic existence, and have provided extensive data on the effects of lamprey attacks in relation to species and size of fish attacked, to place of attachment, and to size and age of the lampreys.

Testing of chemicals to find a substance highly toxic to larval lampreys, in concentrations harmless to fish, uncovered several promising compounds. Field tests will determine their practical value.

To explain enormous overwinter trout losses in most streams in the United States, native and hatchery trout have been stocked in four experimental stream sections at Convict Creek experimental station in California. Water flow and fish movements in these sections, which total a mile in length, can be controlled. Survival in these sections from May to October 1951 was 37 percent for rainbow trout and 39 percent for brown trout.

Research to improve fish-hatchery production and efficiency was expanded. New drugs and chemicals were tested to develop better prophylactic treatment for hatchery fish. Experiments indicate that although sulfonamides are effective in controlling several common fish diseases they are unsuitable for treating others. Antibiotics, such as terramycin and chloromycetin, have cured and prevented some diseases for which no cure was previously known. Identification of several new bacterial fish diseases is being attempted, and control methods are being investigated. In nutrition experiments on salmon and trout, modification of regular hatchery production diets, to remove deficiencies in vitamins and other requirements, resulted in reduced cost of fish production and healthier fish better able to survive after planting. Feeding trials on salmon have resulted in development of several new diets and a number of substitutes for ingredients now incorporated in standard diets. Shallow-pan and basket types of vertical egg incubators, developed for saving space and for economy in operation, proved satisfactory for eggs and fry; the high-humidity cabinet proved satisfactory for eggs but unsatisfactory for fry. Experiments show it is possible to incubate, hatch, and rear chinook and silver salmon, and cutthroat and rainbow trout, in water from Dorena Reservoir, an Oregon flood-control project of the United States Corps of Engineers; in some years the water may be too warm for satisfactory incubation of chinook-salmon eggs.

Marine Fisheries

A comprehensive oceanographic survey is being conducted in the Gulf of Mexico to delimit the areas of greatest fertility, which may coincide with the areas of greatest potential fish production. This requires determination of the chemical composition and the current patterns of these waters. To determine the chemical composition, new techniques are being developed to measure quantitatively certain organic compounds in sea water. It has been established that these compounds are byproducts of biotic activity, and so reflect the distribution and concentration of the nutrients on which all life in the sea depends.

Findings support the theory that waters of the Gulf outside the influence of land drainage (which supplies the essential nutrients) are relatively sterile, and the productive fisheries of the Gulf must be largely confined within the 100-fathom contour, where the influence of the major river systems is effective.

The research vessel *Alaska*, used in these surveys, has been on loan to the Navy during part of the year, for high-priority oceanographic surveys. This arrangement, essential to the national defense, has limited research in the Gulf.

The immediate cause of "red tide," the plague that killed millions of fishes off western Florida in 1946 and 1947, has been ascribed to a tremendous abundance of the dinoflagellate *Gymnodinium brevis*, found in enormous numbers in the affected areas. A toxic substance of unknown nature, associated with the organisms, causes the mortality. The object of the program is to determine what factors bring about an overgrowth of plankton in general, in order to understand the causes of the red tide. Organisms must be grown in pure culture to ascertain their nutrient requirements, and some progress has been made in this.

Research in the North Atlantic centered around the proposed international regulation of the haddock fishery on Georges Bank. Results of mesh-selectivity experiments indicate it will be necessary to use a net having an inside stretched mesh of 4½ inches to protect haddock under 2½ years of age now caught and discarded. A method of accurate prediction of catches of haddock, necessary to the interpretation of the effect of the proposed regulation, has been devised.

Progress was made in an intensive study of the imperfectly known biology of the redfish, New England's second most important commercial species; and studies of the migration of Atlantic tunas yielded information on the distribution of that important species.

A survey is being made of the sport and commercial fisheries of the Delaware Bay area to determine the effects of industrial pollution on the marine fisheries in the area.

The Service, the Scripps Institution of Oceanography, the California Division of Fish and Game, the California Academy of Sciences, and the Hopkins Marine Station of Stanford University, with the support of the industry (through the California Marine Research Committee) are continuing the study of the Pacific sardine, greatest contributor to the fish catch of the Nation until the sharp decline in abundance after 1944. The problem is to determine the size of the sardine population in various years and the causes of fluctuations, by establishing the variations in the amount and range of spawning, and in the prevailing current patterns and other characteristics of the marine climate off the west coast.

In 1951, as in the past, spawning occurred chiefly from January through June and was most abundant in March, April, and May. It was confined to the area between Point Conception and Point Abreojos. Within this area there are two centers of spawning, one off central Lower California, the other off southern California. Coverage of the area is extensive and flexible enough to show deviations in time and place of spawning. This is important since successful year classes may differ considerably from unsuccessful ones in place and time of spawning.

The evidence at hand indicates that "successful" sardine spawning on which the rehabilitation of the fishery must depend, occurs only when the spawning extends over a large section of the coast. Because the spawnings of 1950, 1951, and 1952 were concentrated in the limited Cedros Island areas off Lower California, there is small prospect that they were successful, and increase in the adult stocks when they mature cannot be expected.

In the central Pacific, studies of the western seas continued to collect information on ranges and distribution of the several species of tuna and on their life histories and migrations. Tuna have been found in greater abundance in the zone of converging ocean currents adjacent to the upwelling of nutrient-rich waters (where plankton abounds) along the equatorial-current system. The rich tuna-fishing ground south of Hawaii, found in 1951, extends eastward at least 2,000 miles toward Central America.

Purse seining for tuna was unsuccessful, not only because of clearer water and smaller and faster schools, but also because of greater prevalence of rough seas than off the west coast of America, where purse seining is commonly practiced. Bait-fishing for tuna in the Phoenix and Line Islands is impractical because bait supplies will not support clipper fishing, although there may be enough for operation of small native sampans. A study of reactions of tuna to chemical stimuli has shown that they react strongly and positively to certain fish extracts in solution. This is especially encouraging with its promise of ultimate development of a substitute for live bait.

Fishing with long lines was successful in the Phoenix and Line Islands and near regions of upwelling adjacent to equatorial currents. Catches were better than the average of Japanese long-line catches in the western Pacific, and better also than the average in the Hawaiian area.

The growth of yellowfin tuna is very rapid; the average gain is 60 pounds in a year among tuna of commercial size in Hawaiian catches, which range from 2- to 4-year-olds. Their spawning period in Hawaiian waters is from early June to mid-September, coinciding with the season of good fishing. Big-eyed tuna, common in the Hawaiian region, were not in spawning condition, although nearly ripe females were found south of the Caroline Islands in July and August and were taken south of the Hawaiian Islands in the equatorial-countercurrent region in November. A clear difference was found between yellowfin-tuna populations of the Hawaiian area and those of the North American west coast.

Biologists, acting as official observers for the High Commissioner of the Trust Territory and for the Fish and Wildlife Service, accompanied Japanese tuna-fishing expeditions to tropical waters, to record biological, commercial, and technical features of the operations.

Shellfisheries

Observations over the past three summers have given numerous indications of a sharp decrease in soft clams on the Atlantic coast. Examination of specimens has established the presence of minute parasites, which may have caused the mortality that in 1949 killed up to 90 percent of the clams in some parts of Massachusetts. To determine the practicability of clam farming, seed clams were planted in experimental beds in Plum Island Sound, Mass., and in five locations in Maine. Predators destroyed most of these plantings; where the predators were less abundant, the clams grew well and survival was high. Studies of the effects of raking and power dredging on hard clams in Narragansett Bay, R. I., showed little difference in their effects on the bottom or on associated forms.

Failure of oysters near Pensacola, Fla., to accumulate sufficient spawn prevented any marked success in breeding experiments. This poor season for oyster reproduction extended to Apalachicola Bay and Mississippi Sound. Production of seed oysters is the limiting factor in stabilizing the industry in Maryland. Various areas were studied to determine seed-production potentialities, and ecological features responsible for variations. The long-perplexing question concerning the source of nourishment for oysters is being attacked at Beaufort, N. C. Plankton that has been held in water in which radioactive isotopes are dissolved is given the oysters to determine the kind and amounts of food utilized.

MAINTAINING THE INLAND FISHERIES

Fishing pressure on inland waters continues to increase. A growing population, an increase in those fishing for relaxation, stream pollution, and easy access to areas where there was once a great amount of natural reproduction, have all contributed to the drain on the fishery resources. An adequate supply of game-fish stocks can be maintained in the future only by a comprehensive management program.

Service activities are directed toward meeting the greatly increased demand for fish for stocking and, at the same time, initiating programs for proper management of the fishery resources. These programs must include the management of the fisheries in great water-use developments, in the national parks and forests, and in waters near population centers.

Modernization of hatchery systems is part of the Service's program. Congress provided funds for continuing the construction and expansion of several hatcheries in the fiscal year 1952 in order to increase the production of fishes for stocking. Construction of new hatcheries continued at McNenny, S. Dak., Millen, Ga., North Attleboro, Mass., and Pendills Creek, Mich. Enlargement and improvement of facilities was continued at Bozeman and Ennis, Mont., Hagerman, Idaho, Hebron, Ohio, Hot Springs, N. Mex., Lamar and Farnsworth, Pa., Nashua, N. H., Tishomingo, Okla., and White Sulphur Springs, W. Va. Funds were provided for the repair of flood damages at Fairport, Iowa, Genoa, Wis., and Guttenberg and Manchester, Iowa, and to start an improvement program at the Craig Brook, Maine, station. The construction allotments were supplemented by an allotment of $135,000 for maintenance of hatcheries not included in the expansion and improvement program.

The Service propagates west-coast salmon on three watersheds, the Columbia River, the Sacramento River, and Puget Sound. Greatest emphasis is on the operations on the Columbia, where six Federal hatcheries collect eggs and rear fish to migration size. The hatcheries above Rock Island Dam are concerned with spring- and summer-run salmon. During the 1951 migration season the ladders at Rock Island Dam were ascended by more than 101,000 red salmon, the largest run of this species over the dam since counting operations began in 1933.

Federal stations on the Lower Columbia are concerned primarily with the propagation of fall king salmon. This work has expanded in connection with the Lower Columbia River Development Program. Evidencing the effectiveness of the operations, during the fall of 1951 the number of adults returning to Service spawning racks was the highest on record although the run of fall king salmon over Bonneville Dam was the lowest on record. Estimates indicate that approximately 20 percent of the fall king salmon ascending Rock Island Dam in 1951 were returning to Service hatcheries. In excess of 57,000,000 king-salmon eggs were collected at lower-river Federal hatcheries in 1951, and an increased rearing program resulted in a record production of fingerlings.

At the Quilcene, Wash., station, silver and chum salmon are well established, and the runs appear to be increasing; work with king salmon is limited at this time to efforts to establish a run in the Big Quilcene River.

The lower Columbia River program has been accelerated during the year by additional facilities at existing hatcheries and by a new hatchery at Willard, Wash. The programs of the States of Washington and Oregon have also been advanced through construction of new salmon hatcheries and rehabilitation and improvement of existing hatcheries. Both States have carried on considerable stream-improvement work. The coordinated efforts of the States and the Fish and Wildlife Service are expected to result in greatly increased production of salmon in the lower Columbia River as a means of maintaining the runs.

On the Sacramento River, both spring and fall king salmon are handled, and the rearing program has remained stable for several years. Approximately 24,000,000 salmon eggs were collected at the

Coleman station this year. The production of fish at that station has increased to approximately 130,000 pounds a year. From present indications, it appears that the run in the Sacramento River is increasing.

The growing interest in sport fishing is shown by the 16,026,699 fishing licenses sold in 1951, a new record. These licenses cost the fishermen $35,554,285, more than three times the amount for any year before 1946. A large percentage of these licenses were sold to trout fishermen, and since the license cost represents only a fraction of the money spent by them the popularity of trout fishing is evident. This popularity has resulted in a constantly increasing demand for legal-sized trout for stocking heavily fished waters.

The value of this stocking has been demonstrated in a number of management areas, but since the demand for legal-sized trout exceeds the supply, the fish hatcheries must step up production of trout through expansion and improvement of facilities. Study of trout waters in National parks and forests is being accelerated to provide information that can be used to better fish habitat and food conditions.

Funds were provided in 1952 to start a rehabilitation program at the Craig Brook, Maine, station, established in 1888. The formerly important runs of Atlantic salmon no longer exist in the streams of New England, and the Federal hatchery at Craig Brook has been selected to produce the fingerling salmon needed for a restoration program for this valuable species.

The mussel- propagation project headquarters at Carterville, Ill., has been continued. The program includes studies of the life history of the pigtoe mussel, the propagation of niggerheads and sandshells in Kentucky Reservoir and Wheeler Reservoir in Tennessee, the propagation of sandshells in the White River in Arkansas, and population studies on the White and Wabash Rivers.

Demand for warm-water fishes for stocking continues at a record rate. A major factor in this demand is the annual construction of thousands of ponds, one-fourth acre to more than 100 acres in size, in a stepped-up program of soil and water conservation. Construction of large, multiple-purpose dams in almost every major river system in the Nation contributes greatly to the demand for predator species for corrective stocking. The production of pondfish was held at a record level during the year despite drought in the Southwest and floods along the Mississippi that curtailed operations at a number of warm-water hatcheries. The high rate of production was made possible by improved management at the pondfish stations and by construction and modernization of rearing facilities at a number of stations. In large water impoundments, management is becoming increasingly important, to reduce rough-fish populations and to maintain game-fish populations at a maximum. The use, in management, of bass and pike as predators has resulted in a tremendous demand for these fishes. More emphasis is being put on the rearing of fingerling wall-eyed pike because its value as a predator has become more evident.

The production of pondfish is only a part of the warm-water program; the program's success depends also upon the effective stocking of fish, and the management of the fishing in ponds and large reservoirs. The Service employs a small staff of biologists who work closely with the States and other conservation agencies in the management of public waters. In cooperation with the Alabama Polytechnic Institute at Auburn, Ala., the Service continues a program whereby its employees receive training in hatchery management and farm-pond inspection and management. A training school for Federal warm-water fish-culturalists is conducted at the Service's station at Marion, Ala. This program is providing selected employees with experience in the latest techniques in warm-water fish-culture. The training program is closely coordinated with programs for the management of public waters and farm ponds.

During the year, studies on the Sacramento River secured data on migrations, spawning numbers, and spawning success, as well as water temperatures and flows. At the pumping plant at Tracy, Calif., various types of screening devices were tested to determine the most effective screen for use in the final installation.

Fish ladders and screening devices are important in the protection and maintenance of trout and salmon in the rivers of the Northwest. The fish ladders at Rock Island Dam are regulated and operated by the Service, and all fish ascending these ladders are tabulated by number and species. This operation involves a minimum of delay in the ascent of fish over ladders, and the tabulations provide a basis for determining the productivity of the hatcheries and the extent of spawning above Rock Island Dam and below Grand Coulee Dam. Federal screening projects include the maintenance and operation of screening devices on Federal projects in Washington, Oregon, Idaho, and Montana. These screens save thousands of migrant fish each year, as the fish are prevented from entering the irrigation ditches and are returned to the rivers by means of bypasses.

The program for stocking and managing suitable waters near military reservations, rest camps, and hospital areas, to provide fishing for members of the Armed Forces and veterans, has shown considerable progress during the year. In Region 3 alone, 19 installations have been surveyed, and fish-management programs are being conducted at 9 of these. Results are similar in other regions. Designed to provide a well-coordinated fishing program for as long as is necessary, this work will be continued and expanded to the limit of funds and facilities available.

TABLE 1.—Production of fishes and fish eggs by Federal hatcheries, calendar year 1951

Group	Eggs	Fry	Fingerlings	Fish 6 inches or over	Total
Largemouth bass		1,070,410	7,585,561	19,978	8,675,949
Smallmouth bass		414,000	173,965	40	588,005
Rock bass			9,510		9,510
Warmouth			4,600	609	5,209
Bluegill			35,975,174	2,918	35,978,092
Redear sunfish			2,030	116	2,146
Channel catfish		60,000	90,254	2,992	153,246
Bullhead			764,470	2,476	766,946
Black crappie			97,037	205	97,242
White crappie			11,860		11,860
Rainbow trout	8,672,028		6,353,502	1,382,083	16,407,613
Brook trout	8,974,070	170,000	3,781,223	493,318	13,418,611
Brown trout	3,488,718		1,581,562	228,246	5,298,526
Cutthroat trout	15,543,943	100,000	6,699,642	30,834	22,374,419
Lake trout			1,401,425	4,611	1,406,036
Dolly Varden			14,542	5,226	19,768
Steelhead trout		75,174	119,438	464	195,076
Atlantic salmon		76,000	246,450	1,993	324,443
King salmon	24,306,587		50,401,113		74,707,700
Chum salmon	3,249,848	16,056,072	490,625		19,796,545
Red salmon	250,000	154,384	1,403,707	59,413	1,867,504
Silver salmon	2,500		597,896	2,588	602,984
Sebago salmon			18,593		18,593
Kokanee	528,000		667,904		1,195,904
Buffalofish			131,500	48,000	179,500
Flounder		91,496,900			91,496,900
Grayling	546,203	506,742	23,533		1,076,478
Lobster		233,800			233,800
Yellow perch			178,425		178,425
Pike	210,000	18,950,280	5,300	91	19,165,671
Walleye	1,145,000	2,400,000	32,361		3,577,361
Pollack		2,625,000			2,625,000
Total	66,916,897	134,388,762	118,863,202	2,286,201	322,455,062

TABLE 2.—Land acquired or in process of acquisition for fish-cultural stations, fiscal year 1952

[In acres]

State and station	Acquired by purchase	Pending title conveyance
Kentucky: Frankfort		114
Massachusetts: North Attleboro		268
Michigan: Pendills Creek	85	
Mississippi: Meridian	7	
Tennessee: Erwin		1
Washington:		
Little White Salmon	34	
Spring Creek	4	
Willard	40	
Total	170	383

RESEARCH IN WILDLIFE MANAGEMENT

The Cooperative Wildlife Research Unit program, now in its seventeenth year, is carried on jointly by the Service, the Wildlife Management Institute, and the land-grant colleges and conservation departments of 16 States and the Territory of Alaska. The program facilitates the training of wildlife personnel, conducts research, promotes education, and provides technical assistance to conservation agencies. During the school year of 1951, 249 wildlife students were graduated from Unit schools. Publications by Unit members, on a wide variety of topics, numbered 160. The Federal expenditure of about $129,000 for this cooperative program was matched several times by State and private funds, manpower, and equipment.

Studies of the mourning dove show that this popular migratory game bird has increased slightly in some of the Southeastern States during the past year, from a relatively low population, but a corresponding decrease on the northern breeding grounds, which supply much of the shooting in the South, has probably offset any gains. Winter and spring studies of woodcock, Wilson's snipe, and clapper rail, indicate that these species have changed very little in abundance during the last several years. Investigations are in progress by the Section of Distribution of Birds and Mammals to find ways of measuring changes in the populations of these migratory birds more accurately, and to determine the relative importance of factors that control their abundance.

Bird-banding facilities of the Service are being further mechanized by the installation of equipment to help service returns and extract statistical information from the files. These facilities are utilized by researchers of many State agencies and educational institutions. Investigations resulted in two major publications this year, an illustrated book on the birds of Newfoundland, and a monograph on the coyote.

Studies shed new light on long-standing wildlife problems—among them, the effects of deer, rodents, and birds on regeneration of coniferous forests; the benefits, in higher productivity, from adequate harvesting of deer; and various census techniques to measure wildlife abundance. Data have been collected from State game agencies for the annual inventory of big game and kill. As wildlife problems are better understood, closer appraisal of accomplishments is needed to guide research effectively, and such a resurvey is under way.

Study of rodent repellents continued at the Patuxent Research Refuge and the Denver Wildlife Research Laboratory. Major emphasis has been upon developing methods of applying active materials in the manufacture of paperboard and other packaging materials. Vinyl films containing amino-trinitrobenzene complexes have resisted rat attacks for more than 6 months under conditions in which unprotected films were penetrated in 10 to 20 days. Repellent materials for minimizing losses to field crops by rodents and other mammals have been evaluated, and recommendations for use released in the form of leaflets. The synthesis of a candidate rodenticide of the anticoagulant type has been completed and is now in pilot-plant production.

On areas laid waste by fires and destructive logging, reforestation by direct seeding rarely succeeds, because mice, ground squirrels, and other small rodents feed upon the seed. The Denver Laboratory, in association with forest-research groups throughout the United States and Canada, has developed a treatment for tree seeds that largely protects them against rodent loss. Field trials with both helicopter- and ground-distributed seed, were made in the fall of 1951. Despite formula imperfections, an encouraging stocking of new seedlings was obtained from seed exposed to rodent attack for 6 to 8 months. Extension of field trials with improved techniques is planned for 1952. The saving in cost over the transplanting of nursery-grown seedlings is appreciable.

For fighting troops the rodent-borne-disease problem can be very serious. After 2 years' intensive study, the Denver Laboratory is prepared to make field trials of helicopter-distributed baits for rodent control. Aerial distribution permits rapid coverage of disease-infected areas. In developing formulas for aerial distribution, consideration was given to protection of humans, domestic livestock, birdlife, and other beneficial wildlife.

Predatory animals in National Parks create many-sided problems. A recent study indicates the feasibility of retaining coyotes as beneficial animals in the parks while preventing their depredations in surrounding localities. More than 400 coyotes were ear-tagged in and near Yellowstone National Park, and returns disclosed that many of the animals, particularly the younger ones, leave that sanctuary. Such migrants can be adequately controlled beyond the park boundaries.

A 4-year study of bird damage to rice in eastern Arkansas is near completion. Field work has revealed that the rice birds, while seriously destructive locally, are neutral or beneficial to the Arkansas rice-growing industry over large districts. Intensive study of the birds involved (chiefly blackbirds) included source of the birds, their feeding activities on farm pests as well as on rice, use of frightening devices, chemical repellents, and reductional control of the enormous midwinter roosts.

Studies have been continued on parasites and other disease factors of Canada geese wintering at the Pea Island National Wildlife Refuge in North Carolina. This study involved field work on Pea Island during the winter, and nutrition and laboratory studies on penned geese at the Patuxent Research Refuge. Harmful effects of parasites have been found related to the protein level of the diet as well as to habitat and migration.

The second major wildlife disease study at Patuxent is of trichomoniasis, a throat disease in doves, which has continued to cause severe losses in small areas of the Southeastern States. An improved method of diagnosis and maintenance of infected material for laboratory study has been devised.

The farm-wildlife study at Patuxent and in southeastern States is building a fund of information valuable at this time in connection with the large land-management program of the Soil Conservation Service. Development of two experimental farms at the refuge is nearly completed. A conservation farm is now in full operation under a plan drawn up by the Soil Conservation Service to test living fences of multiflora rose, field borders, and other soil-conservation practices. During the next few years information on the effect of these measures on wildlife will be made available to wildlife technicians and farmers. Although present experiments with herbicides for checking the spread of multiflora rose will not be completed until 1953, studies indicate that a combination of 2,4-D and 2,4,5-T will produce a complete kill.

Investigations in the Southeast include tests of quail-management practices on large plantations. Bicolor-lespedeza strips appear valuable where hunting is carefully regulated, but since they concentrate quail during the hunting seasons they may not be suitable for public-hunting areas.

Studies of the effects on wildlife of chemical control of insects during the summer of 1951 along the Middle Atlantic coast have indicated that DDT spray is harmful to the commercially important blue crab, but that there is little evidence of direct mortality of mollusks and birds. The study is continuing.

Waterfowl studies at Patuxent have included study and demonstration of habitat management, methods of controlling undesirable plants, and propagation and introduction of useful plants. Cash Lake has been improved for waterfowl by drawing down water levels in alternate summers and restoring them in the fall. Heavy crops of marsh annuals have thus been made available.

Intensive studies were made in Maryland and Delaware on control of Hibiscus and Phragmites, two aquatic weeds. Hibiscus can be controlled chemically by the use of 2,4-D or by two underwater cuttings; Phragmites responded to successive diskings or underwater cuttings, but is resistant to chemical treatments. Much of the habitat-management program is being summarized in a manual on weed control in waterfowl habitat.

Pheasant and quail studies are attempting to determine protein and mineral requirements of these species and the part played by nutrition in distribution and general welfare. Results of the past year indicate that the calcium-phosphorus balance may be important in limiting the range of the pheasant in some areas.

The search for foreign game birds that might thrive where native species are not productive has been continued. With the cooperation of the Wildlife Management Institute and the State game commissions in Arizona, New Mexico, and Utah, more than 750 wild chukar partridges, trapped in Turkey, have been released on selected test areas. Particular attention is being given to the choice of species that will not be destructive to agricultural crops nor compete seriously with native American birds. Shipments of chukars were quarantined and tested for disease by the Bureau of Animal Industry at Clifton, N. J., before release to cooperating States.

PUBLIC USE OF NATIONAL WILDLIFE REFUGES

The acquisition, development, and management of the national wildlife refuge system continued along normal lines. The anticipated increase in Duck Stamp funds for land purchase will not be felt until the coming year. At the same time, demands for the public use of refuge lands increased, in some instances before development was completed.

Refuges are managed on a multiple-use basis, so far as this can be accomplished without defeating the primary objective for which each was established. This has permitted an increasing public use of refuges for recreation. It is estimated that there were 3,442,917 visitors on the national wildlife refuges in 1951. More than a third, or 1,309,362, enjoyed fishing; while less than 40 of the 275 refuges provided 222,470 visitor-days of hunting. Opportunities were afforded for picnicking, swimming, sightseeing, and birdwatching, and these, together with business and official use, amounted to nearly 2 million visitor-days.

Many a refuge, because of its remote location, provides the only recreational opportunities in its part of a State. This is particularly true of the 59,000-acre Wichita Mountains Wildlife Refuge which serves as a recreational area for southwest Oklahoma and northwest Texas, with an estimated 668,900 visitors in 1951. The famous Easter Sunrise Service was attended by 56,000 persons. Motoring and sightseeing are most popular. Fort Sill, which is adjacent, uses the refuge as its primary out-of-doors playground. The number of visitors has increased annually, as have problems of cleanup, patrol, fire prevention, and general maintenance items not covered in current appropriations. The Bitter Lake National Wildlife Refuge and the nearby Bottomless Lakes State Park provide the only areas suitable for outdoor recreation in their part of eastern New Mexico. In addition, the refuge provides fishing and picnicking opportunities for several thousand of the personnel at the Walker Air Force Base.

Lake Darling on the 32,000-acre Upper Souris National Wildlife Refuge has proved one of the best fishing spots in North Dakota. On opening day the crowd of anglers, picnickers, and sightseers was estimated at 5,500. Many northern pike weighing over 20 pounds were caught. Similar enthusiasm for fishing was demonstrated on opening day at Lake Andes National Wildlife Refuge in South Dakota. Both dikes were crowded with cars, and as places were vacated others moved in. It was estimated over 5,000 persons fished on the lake that day.

The 49,500-acre Tennessee National Wildlife Refuge represents another type of fishing. On favorable week ends during the height of the spring crappie-fishing season, 18 to 20 thousand fishermen use the extensive shoreline of the middle section of Kentucky Reservoir on the Tennessee River. Similar uses are made of the 34,000-acre Wheeler National Wildlife Refuge, Ala., which is upstream, and in addition there is heavy commercial fishing, including the harvesting of mussels, both for food and for shells for buttons. A study of fishing activity on the Chautauqua National Wildlife Refuge, Ill., disclosed that 80 percent of the fishermen traveled 50 miles or more to fish on the refuge—200 traveled more than 200 miles each.

The Atlantic-coast refuges attract an unusually large number of bird observers. Back Bay, Chincoteague, Bombay Hook, Blackwater, Monomoy, and Parker River National Wildlife Refuges were visited by numerous bird clubs. Over a period of years, a great variety of birds and rare species have been seen on these refuges. Weekly tours were conducted and a nature trail was developed on the Seney National Wildlife Refuge, Mich., in order to acquaint tourists with the refuge program. Similar tours were conducted on the Salton Sea National Wildlife Refuge, Calif.

On the 19,000-acre Fort Niobrara National Wildlife Refuge, Nebr., convenient public access was provided to the buffalo and elk exhibition pastures. Many persons expressed pleasure at seeing buffalo near at hand. Similar pastures have been provided on the Wichita Mountains Wildlife Refuge, Okla., and the 18,500-acre National Bison Range in Montana.

The training of Explorer Scouts was inaugurated on the 329,000-acre Okefenokee National Wildlife Refuge, Ga. During the first 3 months of 1951, several encampments of 15 to 100 scouts, lasting 3 days, were made on Billy's Island. A total of 725 scouts and leaders participated.

Visitors from more than half the States and from five foreign countries registered at the 47,000-acre Aransas National Wildlife Refuge, Tex. Most were there during the winter months when all the surviving whooping cranes were on or near the refuge. The winter concentrations of geese on the 65,000-acre St. Marks National Wildlife Refuge, Fla., attracted many visitors, as they did also on large refuges in North Carolina, South Dakota, and Michigan.

Five national and two sectional dog trials were held on Crab Orchard National Wildlife Refuge, Ill., during 1951. While these trials attracted only a small part of the 395,132 visitors, they demonstrated a type of use already adapted to several other refuges.

A special bow-and-arrow season for deer was provided on the 65,000-acre Kentucky Woodlands National Wildlife Refuge. Similar hunts have been held on refuges in North Dakota and Wisconsin. During an archery hunt on Blackbeard Island National Wildlife Refuge off the coast of Georgia, 26 hunters secured 11 deer, several raccoon, and one 6-foot rattlesnake.

Waterfowl hunting adjacent to several refuges has become popular and presents several problems. Some 12,500 persons hunted outside the Sand Lake National Wildlife Refuge in South Dakota. Many stopped at refuge headquarters for information. Somewhat the same situation exists at Horicon National Wildlife Refuge in Wisconsin. Goose hunting in that vicinity is now described as the best in the State.

Grazing, farming, timber-cutting, haying, and trapping are encouraged as management tools to improve the habitat for wildlife. These operations are conducted annually by several thousand permittees. On the 61,000-acre Mud Lake National Wildlife Refuge in Minnesota, the harvest of clover seed, a crop of honey from bees placed on the refuge under permit, and the taking of furs by local trappers netted substantial revenue to both the Government and permittees. Products or resources surplus to the needs of the various areas are sold or otherwise disposed of, and 25 percent of all receipts are returned to the affected county in lieu of taxes. In the fiscal year 1951, receipts from these sales amounted to well over a million dollars.

Harmful encroachments on refuge lands are increasing. They are of two general classes. The first involves the use of lands rather than of resources. Bombing areas, artillery ranges, and other military purposes constitute the most extensive use; requests for road, drainage pipeline, and electric-transmission-line rights-of-way are less disturbing. Requests for military use of these lands pose the greatest problem with respect to encroachment. This Service has entered into, or is now processing, 23 agreements with the Defense Establishment, involving the use of 20 refuges and 1,372,040 acres of land. This figure does not include a considerable acreage which, owing to security restrictions, cannot be determined accurately. Five agreements concern the use of big-game ranges, two cover Alaskan areas, and most of the rest involve migratory-waterfowl refuges within the United States.

In many instances these agreements have been worked out to satisfy defense needs, while permitting continuation of essential wildlife management. In others, there have been high-handed trespass and complete disregard for the wise use of the affected natural resources. In some instances installations have actually been completed before permission for use was requested. Too often the belief is expressed that refuges are little different from unoccupied public lands; that use by the military must be on their own terms, without regard to other important uses, and often presupposing a transfer of jurisdiction.

TABLE 3.—Land acquired or in process of acquisition for wildlife conservation purposes under the Migratory Bird Conservation Act, by exchange, and by other acts of Congress, fiscal year 1952

[In acres]

State and refuge	Acquired			Pending title conveyance
	By other than purchase	By purchase	Total	
Arizona: Cabeza Prieta		1	1	
California:				
Colusa				560
Merced		2, 562	2, 562	
Sutter				1, 005
Colorado: Monte Vista				2, 259
Florida:				
Chassahowitzka		2, 342	2, 342	9, 410
Loxahatchee				1, 117
St. Marks				8
Georgia:				
Okefenokee				62
Piedmont				267
Idaho: Deer Flat		13	13	59
Iowa:				
Union Slough		30	30	2
Upper Mississippi				62
Kentucky: Kentucky Woodlands		1	1	93
Maine: Moosehorn		190	190	33
Maryland: Chincoteague				320
Minnesota:				
Rice Lake				86
Upper Mississippi		57	57	465
Mississippi: Noxubee	695		695	851
Missouri:				
Mingo		67	67	23
Swan Lake		88	88	
Nebraska: Fort Niobrara				640
New Jersey: Brigantine		7	7	707
New York: Wertheim				8
North Dakota:				
Lake Zahl				745
Lower Souris				2
Oklahoma: Salt Plains				80
Oregon:				
Cold Springs				215
Malheur		3, 618	3, 618	80
Upper Klamath				4, 378
South Carolina: Carolina Sandhills				51
Virginia: Chincoteague		11	11	154
Washington:				
Little Pend Oreille				1, 111
Turnbull	19	329	348	680
Willapa		265	265	
Wisconsin:				
Horicon		20	20	113
Upper Mississippi		119	119	60
Total	714	9, 720	10, 434	25, 706

This Service will continue to extend fullest cooperation in making refuge lands available for defense purposes by means of a departmental permit, supplemented by a memorandum of understanding executed by the respective Secretaries, rather than by actual transfer of the lands.

The exploitation of resources, particularly oil and gas, presents a constant threat to wildlife and its habitat and one that can be expected to increase rather than diminish. This Service has taken the firm position that oil and gas operations must be excluded from refuge lands so far as possible. Experience indicates conclusively the basic incompatibility of oil and gas operations and waterfowl management. The intensive use and development which of necessity accompany oil and gas operations preclude the maintenance of marsh areas in a natural, balanced condition, thereby limiting if not destroying the value of such habitat for migratory waterfowl.

ADMINISTRATION OF FEDERAL STATUTES FOR PROTECTION OF FISH AND WILDLIFE

This year the enforcement staff was increased by 21 additional game management agents, located in areas where they were badly needed. Increased apportionment of revenues from the sale of duck stamps made the addition possible. Results showed clearly how great the need is for more protection to the wildlife resources the Service is obligated to maintain.

With an estimated 20 million Americans hunting, pressure on the Nation's wildlife resources is greater than ever before. In spite of advances in conservation education and a growing awareness of the need for protection, game-law violations have risen as the hunting pressure has increased.

A system of temporary assignment of agents to trouble spots was further developed to meet the enforcement problems. This system increased the enforcement effort in several areas during critical periods, which helped prevent violations and utilized available manpower to the utmost.

It has long been recognized that field agents familiar with game management are an invaluable information-gathering facility. During the past year a formalized system of reporting game conditions was improved upon, so that the Service received current data on a more extensive basis than in previous years.

Although the primary responsibility of a United States game management agent is law enforcement, an important duty is that of assisting and advising farmers on control methods to alleviate crop damage by migratory birds. In connection with the crop-depredation problem, a member of the Service's Branch of Game Management met with wildlife officials and citizens of Canada and explained crop damage abatement methods practiced by the Service, and furnished them with a pamphlet of instructions on control devices and their application. As a result our neighbors have indicated that they intend to adopt several of the suggestions, which will aid both countries in approaching a mutual problem on common ground.

The Branch of Game Management was completely reorganized. The Section of Waterfowl Investigations was transferred to it from the Branch of Wildlife Research; a unit of management in addition to enforcement was created at Central and Regional Office levels; and lines of responsibility for units and for individuals were defined. The reorganization in effect puts all matters pertaining to waterfowl regulations within this Branch, assuring more efficient administrative control than was possible in the past.

Two special investigations were made to carry out our undercover program for exposing and apprehending individuals engaged in market hunting.

TABLE 4.—Summary of penalties imposed for violations of wildlife-conservation laws, fiscal year 1952

Act	Convictions	Fines and costs	Jail sentences
			Days
Migratory Bird Treaty Act	673	$39,440.26	185
Migratory Bird Conservation Act	36	1,200.02	1
Migratory Bird Hunting Stamp Act	65	1,943.50	
Lacey Act	1	125.00	
Bird Reservation Trespass Act	1	10.00	
Bald Eagle Act	1	50.00	
Upper Mississippi River Refuge Act	2		120
State laws, cooperative prosecutions	4,150	112,492.20	
Total	4,929	155,260.98	306

TABLE 5.—Cases of violations of the Migratory Bird Treaty Act disposed of, fiscal year 1952, and cases pending on June 30, 1952

Disposition	Number	Pending	Number
Conviction	673	From preceding year	383
Dismissal	42	New cases	781
Nol-pros	67		
Closed without prosecution	59	Total	1,164
Found not guilty	73	Disposed of during year	915
Closed, by death	1		
Total	915	Pending at end of year	249

COOPERATIVE CONTROL OF PREDATORS AND RODENTS

Protection of the Nation's food crops from destructive rodents, and its livestock and game from predators, is often an economic necessity. Improved techniques to prevent such losses are an investment that brings direct savings to farmers and industry as well as better hunting for the sportsman.

Wise use of natural resources includes protection of grass and other forage essential to production of meat and conservation of water and soil. On the western range, an area of more than three-fourths of a billion acres, there are annually available millions of tons of forage once consumed by rodents which are now kept under control in many communities by Service-approved projects. These savings, and control of predators, have added millions of dollars to the value of livestock and game resources. As an example, in Montana an estimated annual livestock saving of more than 3½ million dollars, a decided increase in deer, and a trebling of antelope production, all resulted from average annual expenditures of $175,000 for control operations over the past 6 years.

Funds for the operations in Montana and 33 other States are in a ratio of about 20 percent Federal money to 80 percent cooperative—an outstanding example of local public support for a Nation-wide activity. The work is accomplished under 53 major agreements, chiefly with State departments of agriculture, livestock, and game, which contribute funds to supplement those raised by a great many county governments and private organizations. Since the Service is responsible for control on vast areas of public land, many of the projects involve those areas as well as private property. The Federal assistance now available does not permit further expansion of the work on a cooperative basis without sacrifice of existing programs. Need for assistance has continued to increase, however. An example is shown in figure 1, which shows the present situation and the Federal aid given with existing facilities in the control of severe rabies epidemics among foxes and other wildlife.

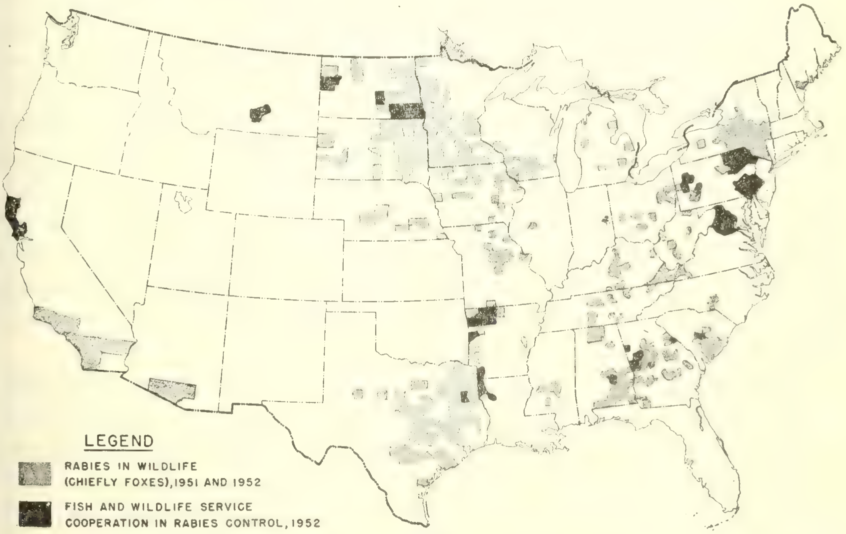

LEGEND
▨ RABIES IN WILDLIFE (CHIEFLY FOXES), 1951 AND 1952
■ FISH AND WILDLIFE SERVICE COOPERATION IN RABIES CONTROL, 1952

FIGURE 1.—Rabies in wildlife, 1951–52.

There is greater need than ever for assistance in food sanitation, specifically the exclusion of rodent filth from grain. Action to enforce provisions of the Food, Drug, and Cosmetic Act, as respects agricultural commodities for human food, has caused grain handlers and others to seek increased technical assistance of the Fish and Wildlife Service. It is estimated that approximately half the wheat raised for cereal products is unfit for human consumption because of contamination by rodents, birds, and insects. Corn is often much filthier—in one extensive area only 3 percent was free from rodent pellets. Rice, sugar, popcorn, dried fruit, and dairy products are less contaminated, but large quantities are condemned annually.

Food industries, farm organizations, and government agencies have united in an intensive long-range food-sanitation program. During the year the Service helped many groups seeking to prevent contamination at its principal sources. Numerous projects were begun to reduce rodents on farms, and thousands of copies of educational leaflets in a series "Grain Is Food—Keep It Clean," were distributed to farm groups and grain-handling organizations. Even greater intensification of the work will be required in the future if the public is to be guaranteed food free from filth.

The use of aircraft in hunting coyotes and wolves is typical of how the Service is extending its limited aid as efficiently as possible. This method was used last year in Alaska and in Idaho, Montana, North Dakota, Oregon, South Dakota, and Wyoming. A total of 2,312 predators were shot by 20 pilot-gunner teams. The most successful day's flight was in cooperating with the Idaho Fish and Game Commission when 9 hours and 10 minutes flying time yielded 78 coyotes and 2 bobcats. This was an unusual situation where coyotes were concentrated on antelope range in soft deep snow. The plane used on this job was operated at a cost of 6.4 cents per mile throughout its ownership by the Service.

An outstanding job of wolf control, using aircraft, was on the Arctic slope of the Brooks Range, Alaska. From a base at Umiat, three planes flew 300 hours, sighted 334 wolves, and made a known kill of 259, plus several unconfirmed. This project was to protect the caribou herds which have been rapidly diminishing, largely through wolf depredations. Before control, the Umiat herd had a calf ratio of only 7.8 percent as compared with 15.1 percent in the Nelchina herd, where wolf control has been conducted for 3 years.

Aircraft were also employed for various assignments in Utah, Nevada, and Florida, the last being a cotton-rat control program in four southern counties, chiefly on sugarcane. Costs have now been lowered from 96 to 18 cents an acre, using zinc phosphide on machine-diced sweetpotato baits. In a small Florida test of hand-placed warfarin-cornmeal bait, as developed in Hawaii, versus plane-distributed zinc-phosphide-grain bait, the former was more effective but cost $32.55 a mile, as against $1.96 for the latter. Cotton-rat control is now generally recognized as a necessary part of Florida cane culture.

Warfarin is replacing older rat and mouse poisons in many areas, and its effectiveness and relative safety permit general expansion of rodent control, even though costs are 30 to 40 percent greater. Rat populations and damage are noticeably decreasing over large areas, being reduced 75 percent in some localities. The Service is aiding cities and counties in starting permanent rat-control programs which keep rats at a minimum through sustained maintenance of warfarin feeding stations at all food outlets. Demonstrations and meetings to train people in modern rat control were held this year in over 600 communities; educational exhibits were maintained at 43 fairs and conventions; and 44 radio and video programs on control were done by Service personnel.

The value of coyote control was proved in several areas. In western Nebraska, the Farm Security Administration formerly refused to make loans on untended bands of sheep because of coyote risks; there is no such restriction since the Service has conducted cooperative coyote-control programs. No herd in any cooperating county has required a herder this year. In eastern Colorado, a record of lamb production showed an average shipping weight of 65 pounds each from bands tightly herded to guard against coyotes, and 80 pounds from bands where coyotes were controlled enough to permit open herding and more natural feeding with less harm to range forage. In Utah the use of 1080 is credited with preventing an annual loss of nearly 2½ million dollars in lambs.

The recorded catch of predatory animals included 50,661 coyotes, 1,633 wolves, 13,476 bobcats and lynxes, 714 stock-killing bears, and 197 mountain lions. In rodent-control operations 11,665,266 acres of land were treated for the elimination of prairie dogs, ground squirrels, pocket gophers, jack rabbits, field mice, cotton rats, kangaroo rats, porcupines, woodchucks, and moles. In addition, 353,677 premises were treated in cooperative campaigns for the control of house rats. Special equipment and supplies used in predator and rodent control, and 319,265 pounds of rodent-bait materials were distributed to cooperators throughout the country by the supply depot at Pocatello, Idaho.

FEDERAL AID TO STATE PROJECTS FOR THE RESTORATION OF FISH AND WILDLIFE

Fisheries restoration

This year has seen the rounding out of a system of Federal aid to the States for fish and wildlife restoration, with the inauguration of the fisheries counterpart to the 14-year-old wildlife-restoration program. Authorized by the Dingell-Johnson Act of the Eighty-first Congress (approved August 9, 1950, 64 Stat. 430), this new Federal-State fisheries-improvement program has already begun to produce valuable results.

Simplified administration of this complementing cooperative activity has been achieved through a modest expansion of the Branch of Federal Aid. Experienced fishery technicians have been added to the Branch, and rules and regulations, including project standards, have been drawn to encompass both the established wildlife activities and the new fisheries work. The year's operations give evidence of the effectiveness of this arrangement for handling the Federal administrative responsibilities.

Excise taxes on specified types of fishing tackle amounted to $2,929,250.71 in the fiscal year 1951. Of this, $234,340, or 8 percent, was used for administration of the act. Allocations were made of $75,000 to Alaska, $25,000 to Hawaii, and $10,000 each to Puerto Rico and the Virgin Islands. The rest, $2,574,910.71, was apportioned to the 48 States. During the first year's operations the States and other beneficiaries obligated $1,499,863.26 for their initial efforts. The funds remaining will be available for expenditure until June 30, 1953, as the act provides that funds may be obligated at any time within 2 years after their appropriation. By June 30, 1952, 42 States and Alaska, Hawaii, Puerto Rico, and the Virgin Islands, had funds obligated on 154 approved projects.

Emphasis in the new program has been on collecting the facts needed to put sport-fish management on a basis of scientific information rather than opinion. In this respect the program parallels the early experience in wildlife restoration. Ninety-four projects were aimed at solving problems through investigational activities, and 63 percent ($945,911.87) of obligated funds were devoted to work of this sort. Several of the projects were for gathering general, State-wide information where it has not been possible for the States to accumulate such basic information in the past. Arkansas, for example, has cataloged the amount and quality of its fishing waters in more than half the counties of the State. Other surveys are aimed at more specific problems, or are confined to smaller areas. New Hampshire is studying the possibilities for fishery protection and development so that the State will have facts on which to base requests for consideration in water-development projects.

A prevalent handicap in fish management is the lack of up-to-date information on the characteristics of fish populations in specific bodies of water, or on the growth and behavior of a particular species of fish in a region. Studies designed to gather such information, and to find ways to improve the quality and increase the amount of angling, are the subjects of projects in 24 States. To illustrate, Montana has carried out a State-wide fish-stocking program for many years. The results of only 1 year's work have shown that in a number of the streams checked, marked revision of the planting program was needed to meet the requirements of the present population and fishing pressure. Improved utilization of hatchery-reared stock, with more fish available from overtaxed hatcheries to go into needy waters, is an immediate result. Until the Federal Aid to Fish Restoration program was created, Montana had funds for no more than a few token surveys and was not in a position to maintain an efficient fact-finding program. This type of activity, developed as a supplement to the regular State program, and previously neglected for lack of finances, is doubtless the result envisioned by the authors and sponsors of the Dingell-Johnson Act.

Several States have begun creel census studies to measure the take of fish by anglers and, where the census covers an entire State rather than a few waters, to provide indices to fish-population changes and trends in fishing quality.

Four States, recognizing the importance of their tidal waters in sport fishing, have begun projects dealing with marine or anadromous species. In California, extensive investigations of the life history, migration, and relative importance of the yellowtail have been started, because of a continuing decline in abundance of this oceanic fish. New Jersey is studying the importance of its salt-water sport fishing, and a similar project in California is focused on surf fishing. New York has begun studies of the weakfish, long a favorite of salt-water anglers. Maine is conducting tests of the practicability of reestablishing runs of the Atlantic salmon on Mount Desert Island.

Rough fishes—the carp, gar, and similar species which make little contribution to sport or food—have long been blamed for inferior fishing. Six States are carrying out studies designed to show the relation of "trash" species to game-fish production, and to find ways to exploit a generally wasted resource. In Georgia, Kentucky, and North Carolina this work is in certain streams of low productivity, while in Florida and Arizona the operations are in warm-water lakes.

Research in Montana and New York seeks improvement of trout culture, including prevention and treatment of disease, improvement of hatchery diets, and selective breeding of disease-resistant strains.

Seven States obligated funds for experimentation in techniques of habitat management or in improvement of technical equipment. New Jersey is testing various chemicals, many developed since World War II, in an effort to find a way to control aquatic weed growth in ponds. In recent years the collection of fish by electric shocking apparatus has become an acceptable and efficient management procedure, but efforts to adapt the apparatus to different types of waters have been hampered by lack of understanding of electrical systems, and by variation in current characteristics of different commercial generators. New York is completing a study of this problem which should clear up much of the uncertainty among fishery biologists, and provide workers with simplified testing devices hitherto not readily available.

In the last decade, public recognition of the material benefits from small multiuse ponds has grown tremendously. The increase in the number of farm ponds—now estimated at more than a million—and the need for maintaining fishing at a high level has brought demand for better pond-management techniques. There is still much to be learned about suitable species, proper stocking ratios, effective fertilization formulas and procedures, and effective regulation of fishing. Kentucky, Massachusetts, Montana, New York, North Carolina, and Oklahoma are all engaged in studies of one or more questions about farm-pond management as related to conditions in their sections of the country.

Apart from the investigational phases of the program, concrete results are being obtained through a variety of projects aimed at creating new fishing waters, or restoring fish habitats that through the years have deteriorated to the point of uselessness. Of obligated funds 24 percent ($360,667.61), have been allotted to 21 projects of this type. Pennsylvania is engaged in the construction of a 32-acre fishing lake in the recreation-shy region near Pittsburgh. Arizona and Colorado have similar projects, and Maryland has begun construction of a series of small fishing ponds throughout the State. California is clearing log jams and other obstructions to increase utilization of salmon and steelhead spawning streams, and several States are reclaiming fishing waters by poisoning worthless fish populations and restocking with valuable species. Wisconsin has under way a project to enhance stream fish habitat by improving land-use practices in the watersheds of 12 streams. Preceded and accompanied by careful evaluations of the effectiveness of the work, in terms of angling success and physical change, this project should make a significant contribution to the understanding of one aspect of the broad soil-conservation problem.

Wildlife Restoration

As a result of increased revenues from the excise tax on sporting arms and ammunition, accomplishments under the Federal Aid in Wildlife Restoration Act broke all records.

Continuing as a major program feature was the development of food and cover for farm game, the major source of hunting recreation.

To assure adequate habitat for quail, pheasant, rabbits, and other species in the face of increasing hunting pressure and intensified farming, 36 States made tree, shrub, and herbaceous plantings on private farmlands. Cooperative agreements were executed with landowners to protect these investments. Field borders of lespedeza and living fences of multiflora rose were emphasized in the Southern and Central States. To the northward and westward, tree and shrub planting on eroded and nonarable areas and on sites set aside for windbreaks was stressed. Indiana, for example, entered into 574 leases with landowners and planted more than four million multiflora rose on those lands. A number of woodlands were fenced to prevent the destruction of wildlife food and cover by grazing stock.

On State owned or controlled refuges and public shooting grounds, habitat was improved for upland game by planting food patches, by thinning and clearing, and by prescribed burning in timber stands unproductive of wildlife. Forty-one States constructed roads, trails, irebreaks, bridges, and storage buildings to facilitate management operations.

Thirty-eight States sought to remedy the inroads of agricultural drainage on waterfowl habitat by restoring and creating marshes. New York's outstanding success with its small-marsh program has prompted other States to follow suit. The Empire State has built 92 marshes totaling 346 acres. Mississippi, Tennessee, Kentucky, and Alabama improved food conditions on large water reservoirs by farming and sharecropping draw-down areas. Nesting boxes were erected n seven States where an absence of tree cavities was limiting wood-duck protection. Utah built a new diversion dam for the Farmington Bay Waterfowl Refuge and fought the botulism menace by hospitalizing sick ducks and burying dead ones.

Overuse of western range lands has resulted in big-game starvation n many localities. In addition to reducing herds to the range-carrying capacity, seven western States are employing newly developed range-revegetation techniques. Arizona, California, and New Mexico continue to build guzzlers and other watering devices to improve arid game ranges. By distributing salt at the proper time and place, it is possible to attract game onto the summer range at an early date, thereby easing the pressure on critical winter ranges. Montana alone distributed 143,000 pounds of salt for this purpose.

Twenty-seven States restocked vacant game ranges by trapping and ransplanting from areas of surplus. Deer, turkeys, beaver, antelope, and raccoons were the major species relocated. Texas not only supplied its own needs, but also furnished white-tailed deer to several outhern States. South Dakota and Wyoming wild-turkey plantings have increased to the point where the original releases are being trapped for stocking other suitable locations.

The purchase and lease of lands for wildlife-management areas decreased somewhat from recent years. Although 28 States engaged in this activity, the acreage declined to 100,880 purchased and 98,049 leased. Eighteen new purchase areas were approved, with the emphasis on waterfowl marsh and big-game winter range.

Investigational projects to furnish facts about current game and range conditions and to develop and test new techniques were in operation in 45 States, Alaska, Hawaii, Puerto Rico, and the Virgin Islands.

An outstanding example of accomplishment has been the 3-year cooperative mourning-dove study by 10 States in the Southeast, which ended this year. Cooperating States adopted uniform objectives and reporting methods, thus permitting direct correlation and evaluation of results on a regional basis. This venture has made it possible to secure basic information for regulating season length and bag limits of a highly mobile and economically important species. Major project accomplishments include development of methods for estimating breeding populations, predicting trends in production, and aging of birds; establishment of arrival and departure dates of flocking doves; determination of migration patterns; and outlining hitherto unknown local shifting about of birds within a State.

Realizing their stake in the management of waterfowl, the States have banded together by flyways to cooperate with the Service on collecting production and migration data. While some of the States previously have made valuable contributions, during this year many more banded together and are using Pittman-Robertson funds to underwrite this valuable work.

Since 1945 the States have placed major emphasis on the establishment of farm-game habitat. Now that these developments are reaching the stage of utilization, many States have begun studies to evaluate and, if necessary, modify their restoration methods.

Research accomplishments were made available to technicians and to the general public through the publication of 388 articles and bulletins by the various State game departments.

RIVER BASIN DEVELOPMENT AND WILDLIFE NEEDS

Of 121 reports by the Service on water developments planned by Federal agencies or private interests under Federal permit, 42 were on Corps of Engineers projects, 24 Bureau of Reclamation, 8 Department of Agriculture, 8 special developments, and 39 on power projects requiring license from the Federal Power Commission. Five reports were on special studies to provide data on the take by hunters and fishermen.

A progress report, Fish and Wildlife Conservation in River Basin Development, was released on the coordination of fish and wildlife interests with water-development programs. It describes the effects of water developments on fish and wildlife, the need for protecting refuges and fish hatcheries which would be affected by water developments, and accomplishments of the Service, in cooperation with engineering agencies, in protecting fish and wildlife at water-development projects. Tables list the projects on which National and State wildlife refuges and management areas have been proposed, and an appendix lists all water-use projects, by States, on which the Service has prepared reports. There is a tabulation of over 1,000 reports prepared during the past 7 years.

On March 21, identical bills (H. R. 7177 and H. R. 7178) were introduced in the House of Representatives to authorize works to develop and furnish water supplies for waterfowl management, Lower San Joaquin Valley, Central Valley project, Calif. They were designed to accomplish the most urgent of the recommendations contained in the Department's report of October 1950 on the grasslands area and vicinity. Hearings were held on the bills during June by a subcommittee of the Committee on Interior and Insular Affairs, and a revised bill (H. R. 8144) was endorsed, as amended, by the committee just as Congress adjourned.

On April 16 a bill, S. 3020, was introduced in the United States Senate to provide for the development and operation by the Secretary of the Interior of a wildlife management area at Grays Lake, Idaho. Endorsed by the Department of the Interior, this bill, if enacted into law, would set aside 55,000 acre-feet of active capacity in Palisades Reservoir for the replacement of Grays Lake storage now used to provide water to the Fort Hall Indian Reservation. This will permit the stabilization of water levels in Grays Lake and the restoration of what was once one of the best natural marsh areas in the western United States.

At the request of the Service, a fish-passage facility is under construction as a part of the Holyoke power project on the Connecticut River in Massachusetts. Developed by the Holyoke Water Power Co. and the Service, this new-type device, consisting of collection facilities and a pressurized pipe, is designed to permit upstream migration of shad, an important game and commercial fish. The shad run of the 1952 spring season provided the first test of the new device, and a few shad, the first in 105 years, passed over the dam along with other fish. Alterations to improve the passage are under way.

The Service and the Bureau of Reclamation are cooperating in a departmental program for waterfowl development within the Klamath Basin in Oregon and California. This program will include recommendations with respect to lands which should be devoted exclusively or in part to migratory waterfowl and to lands which should be placed in reclamation homesteads. At present there is a conflict in views of the two agencies regarding the disposition of lands within the Executive Order boundaries of the Lower Klamath Lake and Tule Lake National Wildlife Refuges in the lower part of the Basin which will shortly be resolved.

The program of developing wildlife habitat in connection with multiple-purpose reservoirs is continuing, with initial plantings in the spring of 1952 at the newly constructed Swanson Lake in Nebraska and at Cedar Bluff Reservoir in Kansas. The program is designed to reduce wildlife losses from inundation of essential habitat. Among other developments, those started in 1950 at Enders and Medicine Creek Reservoirs in Nebraska and Angostura Reservoir in South Dakota are already being used by the pheasants, grouse, and other species.

On November 28, 1951, the Federal Power Commission issued a license to the city of Tacoma, Wash., for construction of a hydroelectric power project (No. 2016) on the Cowlitz River. Issuance of the license had been opposed by the Department of the Interior and the State of Washington Department of Fisheries and Game in view of the probable adverse effects on the salmon resource. The State of Washington has now taken the issue to the courts. The license, however, did require the licensee to construct and operate such protective devices as may be prescribed by the Commission.

A similar case is the Pelton project (No. 2030) on the Deschutes River in Oregon. The Federal Power Commission issued a license on December 21, 1951, despite opposition by the Department of the Interior and the Oregon State conservation agencies because of expected losses to the valuable salmon runs. The State of Oregon has taken the issue to the courts. Here, too, the licensee is required to construct and operate such protective devices as may be prescribed by the Commission.

On June 16, a representative of the Service, acting for the Department of the Interior, presented a statement at a Federal Power Commission hearing at Spooner, Wis., on the proposed power project (No. 2097) on the Namekagon River. The Service, the Department, and the Wisconsin Conservation Commission opposed the project because of the detrimental effects it would have on the unique float-fishing for smallmouth black bass and on the scenic beauty of the stream. A decision has not yet been announced by the Federal Power Commission.

In cooperation with the States, the Service continued its wet-land inventory which includes the location of marsh, swamp, and overflow lands, classification with respect to plant ecology, and evaluation to show existing or potential contribution to meet present and future wildlife-recreational needs of the Nation. The completed wet-land inventory will have far-reaching practical applications. Principally, it will point out the high-priority wildlife areas—ones where wildlife values should be given top consideration before any drainage to promote some other type of land use is proposed. Land-use agencies and conservation interests will be alerted to the need for dedicating such lands to wildlife use.

At the request of the Trinity Bay Soil Conservation District, the Service developed a plan for carrying excess waters from upland-drainage projects through the coastal marshes to the Gulf, while safeguarding or even enhancing wildlife resources of the marshes. The plan included recommendations to provide agricultural drainage without appreciably affecting the water level of the marshes. Such a cooperative program can set the pattern for similar developments throughout the Gulf Coast region.

The second year of investigations in North Dakota, South Dakota, and Minnesota to determine the relative value of "potholes" (small water and marsh areas) as breeding habitat for waterfowl produced significant results. A preliminary report shows that the prairie pothole area within these three States produces about 3 million ducks, with the larger Canadian portion producing a correspondingly larger number. Loss of potholes by drainage in the three-State area is placed at about 2 percent a year. Such losses, if continued at this rate, would eventually mean severe reduction of essential breeding ground, accompanied by an inevitable decline in the duck population. Negotiations are under way with the Department of Agriculture to resolve the agriculture-wildlife conflict and to formulate policies recognizing the interests of both the farmer and the duck hunter.

INTERNATIONAL COOPERATION IN CONSERVATION

International Conservation Agreements

International cooperation in conservation continued, with development of new agreements and implementation of existing ones.

On May 9, 1952, representatives of the United States, Canada, and Japan signed the International Convention for the High Seas Fisheries of the North Pacific Ocean. On July 4, 1952, the United States Senate ratified this agreement, which provides much-needed machinery for protection of the great fishery resources off the west coast of North America, and for amicable settlement of differences arising from the exploitation of the fisheries of the North Pacific Ocean by the three nations. The two Houses of the Japanese Diet ratified on June 17 and July 5, 1952. It is hoped that Canadian approval will be obtained soon so that the agreement can be brought into force. An officer of the Fish and Wildlife Service was a member of the United States delegation to the conference at which this agreement was formulated.

In September 1951, representatives of 20 nations and several international organizations met in Lima, Peru, to discuss the desirability of establishing a Latin American Regional Fisheries Council to encourage cooperation among Latin American States in the solution of a multitude of problems in the fisheries of the area. The agreement formulated at the conference has been transmitted to the governments concerned for their approval. The agreement will enter into force when five governments give notice of acceptance. It is hoped that the first meeting of the organization can be held in the fall of 1952. An officer of the Fish and Wildlife Service was a member of the United States delegation to the conference at which this agreement was formulated.

The International Commission for the Northwest Atlantic Fisheries held its second annual meeting at St. Andrews, New Brunswick, Canada, in the first week of July 1952. Since the first meeting of the Commission, two additional signatory Governments have ratified the Convention which established the Commission, bringing the total of ratifications to seven: Canada, Denmark, Iceland, Norway, Spain, the United Kingdom, and the United States. Of the three signatories which have not yet ratified the Convention (France, Italy, and Portugal), Portugal is expected to take action in the immediate future. All of the signatory governments except Italy were represented at the meeting, as was the Food and Agriculture Organization of the United Nations and the International Council for the Exploration of the Sea. At this second meeting, the Commission, in addition to completing its organization, laid the foundation for an approach to the solution of technical problems; and approved a recommendation for a restriction upon gear used in the haddock fishery off the coast of New England. The gear regulation will enter into force when accepted by the United States and Canada. Dr. J. L. Kask, Assistant Director of the Fish and Wildlife Service, who is one of three United States Commissioners, was elected chairman of the Commission for the next year.

The Inter-American Tropical Tuna Commission, established by a Convention between the United States and Costa Rica, met for the third time on September 1, 1951, in San Diego, Calif. This Commission was organized in July 1950, and has made notable progress toward its goal. A scientific staff has been acquired and investigations have begun. The Commission's fourth meeting is scheduled for August 1952. Dr. J. L. Kask is one of three United States commissioners.

The International Whaling Commission held its fourth annual meeting in London in June 1952, at which time the Commission reviewed whaling operations during the past year, and adopted certain amendments to the schedule of the 1949 Convention for the Regulation of Whaling, with a view to more effective regulation of the industry. The United States is represented on the Commission by Dr. Remington Kellogg, Director of the United States National Museum, United States commissioner, and Dr. J. L. Kask, deputy United States commissioner.

Continuing work begun in 1924, the International Pacific Fisheries Commission met in January 1952 at Seattle, Wash., to consider halibut regulations for the 1952 season and research programs for the new fiscal year. Before his resignation from the Federal service in April 1952, Milton C. James, Assistant Director of the Fish and Wildlife Service, was one of three United States commissioners. Appointment of a replacement for Mr. James is pending.

The International Pacific Salmon Fisheries Commission met in September 1951 at Horsefly, British Columbia, Canada, in January 1952 at Seattle, Wash., and in June 1952 at Ottawa, Canada, and Washington, D. C. At these meetings the Commission approved regulations for the Fraser River sockeye salmon fishing industry for the 1952 season, and considered scientific investigations for the new fiscal year. The Director of the Service is one of three United States commissioners.

International Technical Cooperation

Under the Point 4 Program, the Service and the Technical Cooperation Administration of the Department of State continued to give assistance to underdeveloped countries of the world. There was a notable increase in the number of countries to which the Service has assigned experts, from two countries in 1951 to eight in 1952.

In Mexico, there is need for both increased production of fishery products and for effective management of existing fisheries. The shrimp fishery (with boats, fishing gear, and freezing equipment purchased in the United States) during the short space of 10 years has rocketed from relative unimportance to first place, with an annual catch of about 40 million pounds. Now, because of fluctuating abundance of shrimp, the problem of wise management of this resource is of primary importance. The fishery mission to Mexico has aided in the establishment and development of the Instituto de Pesca del Pacifico. The purpose of this Institute, which is financed by th fishing industry and the Mexican Government, is to provide the ir formation necessary for management of the marine-fishery resource The Mexican Government and the Rockefeller Foundation are deve oping a project for rural fish culture. The fishery mission is assistin in this project, which has the merit of producing fish in the areas o greatest need for protein foods.

The fishery mission to Peru was continued, with two experts i residence throughout the year and a third for 6 months. Plans for marine biological laboratory have been set aside for the present, bu progress has been made in design of a vessel for exploratory fishin and for oceanographic investigation. The fishery technologist mad further progress in training the staff of canning inspectors and i developing methods for low-cost preservation of fish. It is expecte that the large fishery terminal in Lima will be in operation in the nea future. In June 1952, the chief of the Peruvian agency concerne with the administration of fish and wildlife was awarded a grant fo travel in the United States for 3 months. This grant will offer a opportunity for extended observation of research and managemen activities of Federal, State, and private organizations in the Unite States.

At the request of El Salvador, an expert was assigned to assist i the development of the marine fishery of that country. Early in 195 a purchasing mission visited the United States and obtained a full equipped trawling vessel. The vessel has made a number of explora tory cruises, and preliminary reports on the catch indicate the pos sibility of developing a fishery of real significance to El Salvador. I is expected that a marine biologist will be added to the staff in the nea future.

Liberia is in need of a large increase in available proteins of anima origin. For a number of years, it has been planned to develop th marine-fishery resources of Liberia, and recently the Service assigne a technician to assist in that development. There are a number c indications that the fishes off the coast can be exploited much mo than they have been in the past and that there is ample opportunit for marketing of fresh fish on the coast and of prepared fish in th interior of the country. There is need for an integrated industr giving adequate facilities for capture, preservation, transport, an marketing. It is expected that a fresh-water technician will be as signed to Liberia early in the fiscal year 1953.

In April 1952, a fishery expert was sent to Israel to survey th facilities of the fishing industry and to determine needs for expansio Israel already has a well-developed fishing industry, and it is expecte that the problems which face it will be solved in considerable pa within the next few months.

Iran has two large fisheries: one of the Caspian Sea, the other of the Persian Gulf. A fishery technologist was recently sent to Iran to assist in developing low-cost methods of preservation, so that fishery products can be made available readily in areas far removed from the points of production. This project was activated so recently that it is not possible to report on the outlook for success.

The Service recently sent a fishery expert to Lebanon to assist in the development of the fishery of the Mediterranean Sea along the Lebanon coast. According to the best information available, the Mediterranean is not a highly productive area, but it is expected that improvement and increase in facilities for capture will result in a notable addition to the available proteins for the diet of the people of Lebanon. It appears that opportunities exist for development of the inland fisheries, particularly farm ponds.

India, a large country with a long and diversified coast line and a large population, is without adequate diet. From December 1951 through March 1952, a fishery expert of the Service made an extensive survey of the existing industry of India and the possibilities for further development. According to present plans, there will be a program of development of the industry to provide for greatly improved and expanded facilities. A Service technician is being given a long-term assignment in India to supervise procurement and employment of facilities, and to coordinate the several parts of the program.

A number of qualified foreign students were trained in the United States during the year, under Government-sponsored programs. Cuba, Finland, Pakistan, and Peru sent students for a year of training; specialists and visitors from many parts of the world came for shorter periods. These programs of instruction for foreign visitors are an important addition to the technical missions to other countries; they provide a corps of technicians to continue work initiated by the missions.

NATIONAL PARK SERVICE

Conrad L. Wirth, Director

Fiscal year 1952 in the far-flung National Park System was a good deal like any one of the preceding 6 years since the end of World War II. Use of the parks expanded again; nearly 37,000,000 visitors were recorded. Old and young still thrill at the sight of a geyser, a glacier, a bear cub in its native haunts; the Liberty Bell, the home of an early president, a battlefield, or the ruined village of prehistoric Americans. In providing for their enjoyment of these diverse sights, the National Park Service has also discharged its primary duty of keeping the 173 areas comprising the National Park System essentially unimpaired.

Though the intrinsic worth of the parks and monuments is intact, fiscal 1952 was no banner year. In the national park system, "tight" budgets for both development and operation have prevailed now for more than a decade and although the visitor total has nearly doubled during this period, too many facilities for them remain unimproved—inadequate, obsolete, uneconomical of operation, maintained in usable condition only with great difficulty.

Patch-on-Patch Poor Policy.—From the standpoint of good public business, the long-deficient budgets are a deeply serious matter. Be it a scenic highway or a park building, or a private sidewalk or a home, patch upon patch is poor and wasteful practice. Scarcely less objectionable is service to the public which, because of inadequate personnel, has to be diluted to the point that few visitors are able to realize from it the satisfaction it is intended to provide. Certainly the immediate result of inadequate financial support is to subtract seriously from the people's enjoyment of the parks and contribute to the gradual destruction of the areas. Through it, we are risking the loss of Americans' pride in the great places of their country. The scenic and historic parks are roots of patriotism; they nourish our love of country, understanding of our past ,belief in our future. At no time in these trying years, amidst a changing world, have we so needed, and so greatly used, the places that provide this nourishment of body and mind and spirit. It is the universal instinct of man to return to Nature for refreshment, and to bolster his beliefs by looking back upon his own history.

Here in America, these deep-seated longings are answered particularly in the national parks, and answered on as high a plane as obtains for any people anywhere in the world. Their value is unmeasurable in kilowatt hours, in board feet, or in dollars and cents. We only know—and we know it surely—by faith in our own civilization, that whatever America puts into her national parks is a sound and reasonable investment, even if there were no cash return at all. Yet this social return is supplemented, and importantly, by an economic return as well. In many parts of the United States, travel is a major economic factor, and one greatly motivated by the existence of such travel objectives as the parks. Travel patterns are often complex, and the inducements to travel hard to segregate; but there is no leader of this third largest industry who would not shudder to think of a situation in which the parks would pass out of existence. Though nothing should be permitted to impair their inherent values, there should be full recognition of their importance as business assets and of the need of providing both plant and personnel for their effective and satisfactory functioning. They create a return to Federal and local governments and support many businesses important in the local and regional economy.

With the concurrence and encouragement of the Department, the Service has continued to plead the case for strengthened budgets; we believe that a steadily growing number in Congress appreciate that the maintenance needs of the parks are real, not imaginary or exaggerated; that public health, safety, education, and morale justify a stand against continued deferment of improvements.

The National Park Trust Fund.—Concurrently with its effort to obtain appropriations commensurate with needs, the Service is launching efforts to build up the National Park Trust Fund, authorized in 1936 to receive and expend donated funds. The limited resources of this fund have proved most helpful on a number of occasions. A larger fund, not supplanting, but supplementing, regular appropriations, could contribute importantly to the furtherance of useful projects to which donors would give and from which they would receive lasting satisfactions. We are hopeful, and confident, that it can be greatly enlarged.

To Round Out the System.—There has long been wide agreement that the national system of parks, monuments, and historic sites should be limited to areas of national significance. However, careful appraisal of the present system leads to the conclusion that certain additions remain to be accomplished before it can be considered appropriately inclusive. There are historic places of large meaning not yet ncluded; there are types of characteristic and distinguished Ameri-an landscape not represented. Of the latter group, the most con-picuous type still lacking is extensive seashore, uncluttered by shoddy evelopment and, to as great a degree as possible, in natural condition. fter several years, during which the prospect of establishment seemed o be receding farther and farther, the Cape Hatteras National Sea-hore Recreational Area, as a result of a donation from private funds, nd the equally important contributions of the State of North Caro-ina, appears now to be within the grasp of the American people.

The Service feels a primary responsibility for suggesting practical ays and means of rounding out the system before areas desirable for nclusion in it are modified or impaired beyond redemption or before evelopments make acquisition prohibitively expensive. Three ad-ances during the past year marked real progress in this direction. ne was the completion of four of the five groups of condemnation uits, involving Everglades National Park lands, to which the United tates had acquired title the previous year by declaration of taking. nother was the acquisition of famed Linville Falls in North Carolina or addition to the Blue Ridge Parkway—one more of the gifts to the ational Park System made by John D. Rockefeller, Jr. The third as the designation of the Virgin Islands National Historic Site, mbracing the most distinguished and historic portion of the town f Christiansted, on St. Croix Island.

Directors Change; Policies Are Unchanged.—During the calendar ear 1951, the National Park Service had three directors. When ewton B. Drury's resignation became effective on April 1, he was ucceeded by Arthur E. Demaray, close associate of each of the receding directors. When he retired in December after more than 8 years of Federal service—more than 34 of them as an employee of he National Park Service—he was succeeded by the present director. ccompanying these changes came questions as to whether they would ean changes in the policies of the Service. As a matter of fact, ational Park Service policies are not expressions of the personal iewpoint of individual directors. They have evolved, become more efinite and more firmly established over a period which began more han 80 years ago, with the establishment of Yellowstone National ark, 44 years before there was a National Park Service. Farseeing itizens and citizen groups have shared in the task of shaping them. here has never been a time when any threat to the integrity of the ational Park System would produce stronger opposition than today; ever a time when any tendency to weaken those well-established olicies, either by legislation or administrative decision, would be ore widely and forthrightly criticized. It is this strong and informed itizen support which is, and will remain, their greatest safeguard.

Related Activities.—The fields of park and recreation planning, and of scenic, scientific, and historic preservation, are extensive, touching every level of government. Several land agencies in this and other Departments are involved. The emergency work of the Civilian Conservation Corps during the thirties pointed up the need for broad, but not compulsive, coordination of park and recreation activities, though it did not mark the beginning of it. That dates back to the earliest years of the Service when its first Director, Stephen T. Mather, and his assistant, Horace M. Albright, later Director, and the Department helped to foster the closely allied State park movement. The Park, Parkway and Recreational Area Study Act of 1936 was a logical development of all the Service's previous relationships with other park and recreational agencies; the studies conducted in accordance with its authority further revealed the inescapable interrelationships of all agencies working in the park and recreation field. More recently, the vast programs, under which great river basins, usually involving several States, are being studied and proper use of their diverse natural resources is being determined, continue to show the interdependence of one phase of land utilization upon another.

We are convinced that the cooperative work in which the Service has participated has needed to be done. It came into the work naturally; it has an obligation to follow through. There is every reason to expect that it will grow healthily, while it broadens and strengthens the whole field of park conservation.

Mississippi River Parkway Survey.—The collaboration of the Bureau of Public Roads, in the Department of Commerce, and of the National Park Service, in the Department of the Interior—each staffed and experienced in planning in a certain field—in making, and reporting on, the 2-year Mississippi River Parkway survey, is an example of cooperative and effective effort of which we are proud. Working with 10 river States and with a 100-man citizens' planning group, the two agencies evolved a new, practical and economical way to apply parkway principles along the 2,000-mile course of the river. It would produce not a national parkway to be administered by the Service but an interstate development under the well-established Federal-aid-to-highways program. The plan contemplates that the Service would provide consultation service to the Bureau of Public Roads, turnabout of the agreement under which the Bureau, for nearly three decades, has provided basic engineering in the development of major roads within the National Park System.

Dinosaur.—The proposal to construct dams at Echo Park and Split Mountain in Dinosaur National Monument continued to engage attention during the year.

The Service continues to hope that agreement on alternative plans can be reached which will leave this extraordinary possession of the American people in essentially unmodified condition.

Before embarking on a detailed account of the year's events, this seems a suitable place at which to quote a profound statement by Allen Sproul, president of the Federal Reserve Bank of New York, in *Yosemite Nature Notes:*

> In my present work I am chief executive officer of an institution with over $12 billion of assets, with over $5 billion of gold belonging to foreign governments and central banks in its custody, and with many more billions of unissued currency and securities in its vaults. There are about 4,000 people to help me with the job. I had something more precious in my care when I was the "lone ranger" stationed at the Mariposa Grove of Giant Sequoias in 1914. In my ignorance, I felt little weight of responsibility then, but I feel it now when I go back to the grove to worship in the shade of the giant Sequoias. I thank God they are still there.

THREATS TO KINGS CANYON AND GLACIER

In February, notice was published of the applications of the city of Los Angeles to appropriate water from the South and Middle Forks of the Kings River for power production. These include both the Tehipite and Cedar Grove sites, just outside of Kings Canyon National Park, and several sites within it. They have been protested by the Secretary of the Interior, the Sierra Club, the Fresno Chamber of Commerce, and others.

In March, the Secretary requested the National Park Service and the Bureau of Reclamation to arrange for a joint survey of the natural resource development possibilities of the Middle and South Forks of the Kings, outside the park. An agreement on the study was reached early in April, and it will be conducted as soon as necessary appropriations are available. In common with many conservation organizations, the Service hopes that alternatives may be found for the Cedar Grove and Tehipite sites and that the latter may ultimately be included in Kings Canyon National Park.

A new threat to Glacier National Park came in the proposal of the Anaconda Copper Mining Co. to build an aluminum reduction plant near the south border of the park. There seems to be no question that noxious fumes from such a plant could affect seriously the plant and animal life of the park. Through former Director Horace M. Albright, who represented the Service in discussions of the situation with company officials, it is learned that the company has chosen one of the least objectionable sites and that it intends to install protective devices.

IMPROVEMENTS

With a backlog of needed projects amounting to $140,000,000 for buildings and utilities, $201,000,000 for roads and trails, and $202,413,000 for parkways, the Service received $1,295,000 for buildings and utilities, $2,500,000 for roads and trails, and $5,825,000 for parkways. Of the parkways funds, $4,200,000 were for the Baltimore-Washington Parkway, of highest priority in the defense road network of the Nation's Capital.

Two factors prevented using even the limited construction funds to fullest effectiveness. They had to be distributed in relatively small amounts to a large number of areas, with resultant costly supervision and construction. The low personnel ceiling permitted few day-labor projects, yet it was difficult and occasionally impossible to get contractors to bid on small jobs. The short construction season in many areas is a further handicap.

Communications.—FM radio surveys were completed at Sequoia, Kings Canyon, Yosemite, and Shenandoah National Parks, and Dinosaur National Monument. Yellowstone is next on the list for such a survey. FM systems were completed at Acadia and Big Bend National Parks and Organ Pipe Cactus and Death Valley National Monuments. The system at Glacier National Park will be completed this fall.

Standard radio specifications prepared by the Service are now being widely used by other Department bureaus. Other agencies also use its certification of radio equipment; increasingly other bureaus of the Department ask its help in preparing bids for radio equipment.

Unfortunately, personnel ceilings have prevented the hiring of personnel to maintain the Service's radio systems, which are only as good as the maintenance they receive. Some means of employing qualified maintenance forces must be found if these systems are to function satisfactorily.

Good progress is being made in interesting telephone and power companies in supplying commercial service to field areas. Outstanding was the successful negotiation with the Rural Electrification Administration to supply power at Big Bend National Park. We are convinced that in many areas the Service can obtain commercial power and telephone services more cheaply than they can be provided with its own facilities.

Park Roads.—Though there are 15,000,000 more automobiles on the highways of the United States than before World War II, that fact is not reflected in appropriations for roads in the National Park System. Of $201,000,000 needed for road development, 87 percent would be for replacement projects, to enable the System to meet the demands of modern traffic.

Contracts for replacement roads, 55.5 miles in length, and costing $2,192,571, were completed in the 1952 fiscal year. These included both 1950 and 1951 projects such as the Clingmans Dome and Newfound Gap roads in Great Smoky Mountains, the Northeast Entrance Road at Badlands, the North Entrance and Boquillas Roads at Big Bend, the Zion-Bryce Approach Road, Route 1 at Lassen Volcanic, the Kings Canyon Road, and the Heart of the Hills Road in Olympic. Road replacements under construction at the end of the year represent a cost of $4,988,392 for 114.2 miles of road. Started in previous years, they were 77 percent completed. Two projects—for Yellowstone and Olympic—with $586,000 programmed, remain to be placed under contract.

Road and Trail Maintenance.—There are 6,242 miles of roads, including parkways, and 7,924 miles of trail in the National Park System requiring annual maintenance. The Service maintains roads at extreme elevations and under extreme climatic conditions from 280 feet below sea level in Death Valley to 13,000 feet above in the Rockies and the Sierras; from the hot and arid regions of the desert, to the swamps of Everglades National Park, and to the rigorous winters of Alaska and the Rocky Mountain region. This great variety of conditions results in abnormal demands for maintenance and abnormal maintenance costs. Annual snowfall of 50 to 60 feet in such places as Crater Lake is common. About $400,000, or 10 percent of maintenance funds, is spent annually to remove snow, with no permanent benefit to road conditions. Less than 4 percent is spent for professional services.

During the past year, 125 miles of roads and 210 miles of trails have been added to the systems in the parks and monuments. These additions have resulted from completion of construction projects, transfer of roads in newly acquired areas, adjustment of mileages in existing areas, and transfer of State and county roads within areas administered by the Service. As of June 30, 1949, capital investment in the highways of the system was $191,000,000; the maintenance estimate for 1953 is 2.2 percent of that investment.

Parkways.—The only funds appropriated for parkways in 1952 were earmarked for the Baltimore-Washington, Suitland, and Natchez Trace Parkways. Thus further progress was, for the time, eliminated from the five other authorized parkways—Blue Ridge, Chesapeake and Ohio Canal, Colonial, Foothills, and George Washington Memorial. All of these are badly in need of work to be done in order to protect the Federal investment already made and to provide for the public safety.

On the Washington-Baltimore Parkway, 3.5 miles of grading and two grade separation structures were completed at a cost of $1,281,456.

Construction contracts on 12 other projects were in progress, to cost $3,660,631. Because of the importance of this parkway in the National Capital's defense highway system, work on it is being pushed as rapidly as possible.

On the Blue Ridge Parkway, with the completion of paving on a 42-mile unit between the James River and U S 60 near Roanoke, a highly scenic section through the Peaks of Otter area was opened to traffic. Completion of 6.1 miles of grading and surfacing connects U S 19 at Soco Gap, N. C., with the newly constructed Heintooga Ridge road in Great Smoky Mountains National Park. The two projects cost $974,146.50. The paving, now in progress, from the Mount Mitchell entrance road to U S 70 near Asheville, will open up the spectacular Craggy Gardens rhododendron area. On this and on the grading of another 5 miles near Asheville, $940,958.50 is being expended.

Under a $120,202.50 contract, paving of the Colonial Parkway through the Williamsburg Tunnel and construction of a 0.9-mile connection to Tazewell Hall Avenue in Williamsburg have been started. Right-of-way for the remaining 12-mile section between Jamestown and Williamsburg has been acquired.

With the completion of paving of 19.4 miles connecting with Mississippi Highway 12, a 64-mile section of the Natchez Trace Parkway was opened to traffic, extending to U S 51, near Ridgeland. Grading of 8.2 miles in Tennessee was also completed. The cost of these two projects was $1,211,267.

A contract was awarded at the end of the year for paving a 4.9-mile second lane of the Suitland Parkway between South Capitol Street, District of Columbia, and Silver Hill Road, Maryland. The remaining 4.1 miles of this defense route between the District of Columbia and Andrews Air Base is still to be paved.

No lands have yet been provided by the State of Tennessee for the Foothills Parkway; therefore, no work has been done on the main route. However, construction is well under way on two bridges and a culvert on the proposed south-bound lane of the Gatlinburg-Banner Bridge section of the Gatlinburg-Caney Creek spur connection to the main line of the parkway.

With no funds, and additional right-of-way needed, no work has been started on the Chesapeake and Ohio Canal Parkway. Several local groups have voiced opposition to its construction.

Major Building Construction.—Despite labor shortages and restrictive controls on certain materials and equipment, the year saw good progress, within the strict limits of available funds, in the Service's authorized building construction program. In the critical building area of the New York City vicinity, contracts amounting to

$160,000 were let for restoration work on Castle Clinton; $25,000 was spent on rehabilitation of the Zenger Memorial room at Federal Hall Memorial; a contract for $157,000 was awarded for construction of six residences and related work, for employees at Statue of Liberty National Monument. The west wharf and the new concessions and public service building were completed and put in service; the old concessions building and comfort station were demolished. When the two old duplex residences are demolished and the old dock piling removed, the major work of rehabilitating Bedloe's Island will have been completed.

In addition to building construction projects mentioned elsewhere, some of the most important undertakings are a new Lake Mead National Recreation Area administration building in Boulder City, now building; the contact station at Everglades National Park; contact station and utility building at Ridgeland, on the Natchez Trace Parkway; and much-needed residences at Lake Mead and Millerton Lake, Grand Canyon, Big Bend, Zion, Everglades, Mount McKinley, Glacier, Great Smoky Mountains, Adams Mansion, and a number of national monuments. The construction program includes other structures such as comfort stations, contact stations, utility buildings, fire lookouts, etc.

Soil and Moisture Conservation.—Approximately 3,900,000 acres of the lands administered by the Service have been badly eroded or seriously depleted by erosion and prior misuse. The "problem acreage" needs protective or corrective work which, it is estimated, would cost about $4,317,450. Of this, more than $1,685,000 is needed for immediate correction alone of areas having severe and critical erosion.

The 1952 appropriation carried $91,200 for this work.

A happier picture is presented with respect to lands leased for agricultural use along the parkways and in historical areas, primarily as a maintenance measure. The conservation requirements of permits issued in Region One result in an annual investment in liming, fertilization, and other soil and moisture conservation practices by permittees of more than $250,000. Merely to maintain the 13,000 acres as open fields would cost the Service $80,000 a year for mowing alone.

HISTORY AND ARCHEOLOGY

The American appetite for history where it was made and for the sites of prehistoric interest shows no signs of abatement. During the travel year that ended last September 30, 13,893,398 visitors were recorded in the historic and prehistoric areas administered by the Service. Despite their numbers, it is estimated that approximately 70 percent of them received personal assistance from Service personnel in gaining insight into their country's history.

Encroachment and Boundary Problems.—The irregular and inadequate boundaries of many of the historic areas administered by the Service constantly pose problems of protecting them from undesirable encroachments. These seem to have been especially numerous during the past year.

In the case of a particularly significant small piece of land adjoining Colonial National Historical Park, Va., refusal of the owners to sell and preparation by one of them to build a house, compelled the Service to resort to condemnation, a step strongly endorsed by the public and leading patriotic and civic organizations. The suit is still to be tried.

The threat of commercial developments to the New York Monuments erected on the Manassas Battlefield is probably averted by the action of the New York Legislature which appropriated approximately $50,000 so the Service could purchase the desired lands for addition to the national battlefield park.

Chalmette National Historical Park, site of the Battle of New Orleans, now divided into two major parts, is threatened with a great industrial development on intervening private lands. Not only would that be unsightly, but it would make it almost impossible effectively to convey to visitors the story of the battle.

For the moment at least, a serious threat to the Adams Mansion, in Quincy, Mass., seems to have been averted. The street in front of this historic home was to have been widened and converted into a through traffic artery. Not only would this have produced a major change in the surroundings but the vibration caused by heavy traffic would have endangered the stability of the house.

Carter's Grove, an eighteenth-century plantation mansion associated with leading Colonial and Revolutionary figures, was threatened with encroachment by a railroad line which the Army planned to construct for training purposes. This estate is in private ownership, but its inclusion in Colonial National Historical Park—when and if means are found to accomplish that—has been authorized by Congress. The Service joined with numerous patriotic organizations in persuading the military to find a different solution to their needs.

Restoration, Stabilization, and Rehabilitation of Historic Buildings.—The official designation of historic sites and structures does not automatically assure their stability; they deteriorate regardless. Restoration is low in priority among processes of protection and interpretation, but it is occasionally the wise thing to undertake.

While funds for rehabilitation and stabilization have been small, some noteworthy accomplishments have been possible. The work of saving the historic sutler's store at Fort Laramie National Monument is nearing completion, after stabilizing the walls, placing new concrete footings, and repairing the interior. The old water wheel and blast machinery at Hopewell Village National Historic Site were restored; for the first time it is possible to interpret the operation of a blast furnace to visitors. At Independence National Historical Park Project, rehabilitation of two historic residences was completed, and is nearing completion for a third. These will be utilized to house project personnel. Repointing of the massive walls of the Castillo de San Marcos, Fla., continued and these are now stabilized. Similar needed repointing is being done at nearby Fort Matanzas National Monument. At Fort Pulaski National Monument, Ga., several casemates have been rehabilitated to house exhibits, and some masonry repointing has been done; moisture control in the casemates remains an unsolved problem.

The roof and gutters of the ante-bellum Beauregard House at Chalmette National Historical Park were repaired; it is boarded up until the house can be restored as an administration and reception center. The Schuyler House, Saratoga National Historical Park, underwent considerable repair and repainting. Situated several miles from the battlefield, it is to be administered by patriotic groups in Schuylerville as a house museum. Important repairs were also required at the Hawkes House, Salem Maritime National Historic Site; at the Adams Mansion; and at Hampton National Hospital Site, Md. At Hampton, a number of the majestic trees which have lent so much to the charm of the site were blown down during a recent severe storm.

The foundations of the early Colonial Governor's house at Jamestown, in Colonial National Historical Park, were excavated and stabilized; the west wing of the Ambler House ruin was also given stabilizing treatment.

Some prehistoric ruins also needed attention. The most notable work included comprehensive stabilization of the west (main) pueblo at Aztec Ruins National Monument, N. Mex.; continued work of the same sort at Kin Kletso (Yellow House) in Chaco Canyon National Monument, N. Mex.; and a long start on two notable ruins in Wupatki National Monument, Ariz.

Assistance in Safeguarding America's Historic Heritage.—The President, the Congress, other Federal agencies, State agencies, and patriotic organizations and individuals have all made numerous calls on the Service for assistance either in appraising the historic values of various sites or in preserving them. Studies were made of 36 places at the request of the President or Congress. These ranged from mysterious Dighton Rock, Berkeley, Mass., carrying an inscription believed to be by the Portuguese navigator Cortoreal, dated 1511, to the John Dickinson House in Dover, Del., to the grave of Sacajawea, Indian heroine of the Lewis and Clark Expedition, and to the memorial site in Brooklyn where 256 Maryland soldiers, killed in the Revolution, lie buried in unattractive surroundings. Such studies require intelligent research and the dispassionate weighing of historical records.

Patriotic organizations, State officials, and individuals pleaded for aid in the interest of preserving 48 places of historic interest. While it is not always possible immediately to suggest means of preservation or even to prevent loss, in a heartening number of instances it was possible to help.

Other Federal agencies asked assistance in studying the historical, archeological, and recreational resources of Alaska, the Virgin Islands, Hawaii, the Saipan District, Guam, and Wake Island. Following on-the-ground investigations by two Service employees—a land planner and an archeologist—they formulated recommendations to the High Commissioner for the Trust Territories concerning preservation and use of such resources in the Territories.

Approximately 120 bills were introduced in the Eighty-second Congress in the interest of historical conservation likely to affect the Service's program. Of these, 38 related to established or proposed areas; 36 to 28 memorial projects; 11 to national cemeteries; 6 to river-basin programs; and 29 were of miscellaneous nature involving 25 different projects. Collaborative aid to the President, the Bureau of the Budget, and the Congress was given by the Service in connection with all of these. In many cases, the advice and opinion of the Service saved the Government considerable sums by giving sound advice adverse to projects which, if approved, would cost large amounts for development and administration.

Historic and Cultural Preservation in Time of War.—The Service's History Division, at the request of the Department of State, agreed to assume leadership in advising on matters relating to a draft of an International Convention for the Protection of Cultural Property in the event of armed conflict. Subsequently it participated in discussions with agencies of the Departments of State and the Army, in an advisory capacity, on a proposed Unilateral Declaration on the Protection of Cultural Property in the event of armed conflict. This group, with representatives of the Smithsonian Institution, National Gallery of Art, and National Archives, conferred on the various questions that had arisen in connection with this task. Though it was recommended that representatives of the United States attend the July meeting of experts in Paris which is to make a final draft of the convention, it was expected that only two observers from the United States would attend.

Historical Research.—The past year has been notable both for the quantity and the quality of research in history, carried on both by Service personnel and by others at the instance of the Service. Perhaps the most significant has been the program conducted at Independence National Historical Park Project, which requires a tremendous amount of research. Though much of it has been carried on by Service historians assigned to the project, its scope has been greatly extended through cooperative programs with the graduate faculties and students at the University of Pennsylvania and Bryn Mawr College. More than 30 graduate students are now completing studies which will meet requirements for advanced degrees and at the same time will give the Service the benefit of their research findings.

Space does not permit a listing of the very large number of historical research projects launched or completed, relating either to existing or prospective historical areas in the National Park System. In addition, a significant reconnaissance of the historical and archeological resources of Alaska was completed as a phase of the Service's recreation study of the territory.

Archeological Explorations.—Archeological work in areas administered by the Service was advanced materially during the year. Of wide public interest were the beginnings of excavations at Fort Frederica National Monument. There the Hawkins-Davidson House foundations were uncovered and left exposed as a public exhibit. A long-abandoned well on the site yielded a quantity of interesting artifacts. The study of the furnace area at Hopewell Village National Historic Site was completed. Further work was done at Glass House Point in Jamestown; funds were donated also for work at Fort Caroline, Fla., on lands acquired by the Service during the year.

Limited excavations were resumed at Effigy Mounds National Monument, Iowa, and preliminary archeological reconnaissance was undertaken at Grand Portage National Historic Site and Isle Royale National Park. In the Southwest, Archeologist Schroeder made an archeological survey of the Lower Colorado Valley, and a site survey of Mesa Verde, begun in the spring, is continuing this summer. A survey of Organ Pipe Cactus National Monument was completed by Collaborator Paul H. Ezell. At the year's end data were being prepared and reports written on excavations at Bandelier, Gran Quivira, Zion, and Canyon de Chelly. Excellent final reports were submitted on excavations at Site 16 and Sun Point Pueblo, at Mesa Verde.

In Region Four, archeological investigation at Fort Vancouver continued. At Hawaii National Park, two native collaborators surveyed prehistoric sites significant in native tradition. The University of California, under contract, began a survey of archeological sites in

Yosemite National Park and Lava Beds National Monument which is continuing this summer.

River Basin Archeology.—The interagency archeological salvage program in river basins, a joint project of the National Park Service, the Smithsonian Institution, and other Federal and State agencies, continued to rescue irreplaceable scientific data from reservoir areas prior to flooding, with the National Park Service assuming larger responsibilities for such work except in the Missouri River Basin. With an allotment of $95,783 for 1952, and with carry-over funds, the Smithsonian was able to carry on its operations in the Missouri basin throughout the summer of 1951, and with other funds, to direct 6 surveys, 11 archeological excavations and 1 historical excavation, in other basins.

The Universities of California, Oregon, Washington, Texas, and Oklahoma, under contract with the Service, performed surveys on a number of reservoir sites outside the Missouri. Similar contracts, for surveys in the Missouri Basin, covered work performed by the Universities of Kansas, South Dakota, Nebraska, Wyoming, Missouri, and Montana, the State Historical Society of North Dakota, the Nebraska State Museum, and the Nebraska State Historical Society. They worked on at least nine major sites. Through their joint efforts invaluable archeological material has been salvaged and our knowledge of the history of the Plains Indians has been increased more in 1 year than it would otherwise have been increased in 50.

IN THE NATURAL HISTORY FIELD

As is to be expected, the increased number of vistors to the national parks and other scenic-scientific areas is reflected in increases in the number served by interpretive programs. For the 52 areas which report such contacts, the year's figure was approximately 14,000,000. That does not mean, of course, that 14,000,000 different individuals were served; but one needs only to observe the overcrowding of the Yavapai Observation Station at Grand Canyon for the several daily lectures, or the long lines accompanying park naturalists on guided trips, or the crowds in museums, or the turnouts at evening campfire programs to realize that visitors take to these easy and pleasant means of learning.

An important aspect of the work of the naturalists employed in the field is that of supplementing the other protection activities of the Service. In talks and informal discussions, opportunities are seized to convey to visitors some conception of the policies of the Service and of the regulations designed to make them effective and to protect the natural features. In many cases, interpretive programs appear to be an effective weapon against vandalism.

The best programs are those that have been developed in accordance with carefully prepared plans. Such planning has been a major concern of natural history personnel in the Washington and regional offices. Distinct progress along these lines can be recorded for Blue Ridge Parkway, Shenandoah, Wind Cave, Platt, Hot Springs, and Mount McKinley National Parks, and Dinosaur National Monument. Platt, Hot Springs, Big Bend, and Isle Royale all need park naturalists, and at least one more position is needed in both Southwestern National Monuments and Rocky Mountain National Park. A regional naturalist in Region One is also an urgent need.

Elk Control and Grand Teton.—About 40 square miles in the northeastern portion of Grand Teton National Park were opened to regulated reduction of elk in accordance with Public Law 787. A take of 600 elk being agreed upon by the Wyoming Game and Fish Department and the National Park Service, 1,200 hunters were deputized as temporary park rangers. Of these, 510 reported for "duty" and killed 184 elk. This was less than 10 percent of the total kill in northern Jackson Hole and about 4 percent of the total kill for the Teton Management Area. Had no elk been killed in the park at all, the total reduction would still have exceeded the goal; the 1951 experience does not support the contention that hunting in the park is necessary for adequate control of the southern Yellowstone elk herd.

Bears and Other Dangerous Animals.—In an endeavor to persuade visitors to comply with regulations prohibiting the feeding, molesting or teasing of bears, more than 1,000,000 red-and-black, briefly-worded printed warnings were handed out to them last summer. Yet, during the summer, 38 persons were injured in Yellowstone alone, and in the majority of cases hand-to-mouth feeding was the direct cause. Troublesome largely because of having become accustomed to handouts, 47 of Yellowstone's bears had to be destroyed. Because other wildlife of the parks is also dangerous, and because feeding or molesting them is detrimental to the animals themselves, the prohibitions formerly applied to bears were extended to include deer, moose, buffalo, mountain sheep, elk, and antelope.

Reduction Programs.—The northern Yellowstone elk herd, a perennial problem of overpopulation, was reduced last winter by about 3,800 head. Favorable weather conditions which induced the elk to move northward out of the park in late December made possible reduction of 3,200 by hunters in Montana between then and January 31. In the park, five live traps caught about 1,200. Of 629 taken out of the park and released in open hunting territory, about 60 percent were killed in legal hunting. Another 563 were shipped out for restocking areas in several States and to public and private preserves. With these reductions, and natural mortality, the herd was estimated to number 8,000 at the end of winter. With an expected 20 percent calf crop, the herd will still be about 4,500 in excess of range-carrying capacity in 1952.

Elk and deer reduction programs were carried out again at Rocky Mountain National Park, and a mule deer reduction program at Zion National Park.

Studies of Wildlife.—Relationships of population to food supply such as those which resulted in the controlled reductions listed above were the subject of considerable study by wildlife specialists, who also carried on a variety of other investigations aimed at ascertaining the survival rate of and factors affecting the welfare of rare or reintroduced species; determining the effects upon park populations of predator control measures near the parks; inventorying bird and other wildlife populations; and other problems affecting wildlife management. Of particular importance are the elk-range studies, and investigations of predator abundance, effect of predators on prey species, and predator migrations, launched at Olympic National Park last spring. The predator-relations study is the outgrowth of brief investigations of elk during the past 2 years.

WORK OF THE MUSEUM LABORATORY

To the uninitiated, the variety of highly valuable and necessary work performed by the Service's museum laboratory is somewhat astonishing. One major aspect of its work is preservation of historic and scientific collections entrusted to the Service; another is the design and construction of museum exhibits. Museums are important tools of interpretation and the Service probably operates more of them than any other agency anywhere.

The laboratory was consulted in preservation techniques by the Army, the Navy, and the National Trust. The variety of work it performs is indicated by such examples as the restoration and preservative treatment given paintings in the famous Independence Hall collection of portraits as well as in five other areas; cleaning and treatment of weapons and various other metal objects; and treatment of old books, maps, and prints. As much storage equipment as could be purchased with the limited funds available was obtained and supplied to field areas in greatest need of it.

A large number and variety of exhibits were designed and built by the laboratory staff. Those for the Ocmulgee National Monument museum were completed in time for the opening ceremonies last November; all exhibits except part of the figures for one diorama were in place when the new Custer Battlefield museum was dedicated in June. Exhibits for the small Ochs museum, on Lookout Mountain, Chickamauga and Chattanooga National Military Park, were installed last January. Using funds donated for the purpose, the laboratory is working on four of the dioramas for the Zenger Memorial Room in Federal Hall Memorial. It built, or is building, exhibits for 11 other areas. It performs a variety of other services, such as review of museum prospectuses, preparation of museum layouts, consultation on museum problems—extended also to several State park authorities—and operation, with the History Division, of an in-service training course in museum methods. Among the students in this year's course was the Director of the Iraq National Museum of Natural History, here on a UNESCO fellowship.

TO AID IN UNDERSTANDING

Previous annual reports have noted the trend, forced upon the Service by overwhelming increases in numbers of visitors and by the lag in numbers of interpretive personnel, toward the use of supplementary means of giving the interested visitor some sense of the meaning of the areas administered by the Service. This trend has been heightened during the past year in the increasing use of self-guidance practices and of audiovisual aids. These have both advantages and disadvantages.

Examples of the procedures which have been adopted to meet these conditions are numerous. A synchronized tape recording and slide projection was installed at Bandelier National Monument, N. Mex., to help orient visitors waiting for the beginning of the scheduled tour of prehistoric ruins. Plans were perfected for installing a recorded talk by public address system on the boat carrying visitors to the Statue of Liberty. With the necessary closing of Montezuma Castle, Ariz., to visitors, a large scale model of that picturesque cliff dwelling was installed under glass in a shelter in the valley below it. This has proved effective in helping visitors understand the construction and use of the original structure. It seems to be a happy solution to the interpretive problem faced when it became necessary to close the ancient structure to visitors.

At Lake Mead National Recreation Area at the reception center in Boulder City, the visiting public is now given orientation on the recreational development and use of the national recreation area by a fine recorded lecture synchronized with automatically projected slides. Similar installations have been placed at Crater Lake, Acadia, and Wind Cave National Parks.

In the scenic-scientific areas, there are today 26 self-guiding trails as compared with 12 in operation a year ago. In a few of these, the guidance is supplied by signs bearing interpretative legends along the trail. Increasingly, however, booklets or leaflets keyed to numbered posts along the route are being utilized. Some of these special interpretive publications have been provided in the Service's printing program; a greater number, however, have been produced by cooperating societies. Particularly notable have been those produced by the Southwestern Monuments Association, headquartered at Santa Fe, and by the Loomis Natural History Association, at Lassen Volcanic National Park. The former provides its handsome booklets for free use on the areas with which they deal, but interested persons may buy them to take home. The latter has issued *A Guide to the Lassen Peak Highway* and other supplementary booklets as sales publications which have proved extremely popular with visitors.

Traveling Exhibits.—A start has been made on the preparation of interpretive displays, intended to serve as traveling exhibits, to cover major phases of the Service's work, something for which there is both considerable demand and real need. The first two, planned by the History Division, and designed and built by the Museum Branch, dealt with the media and methods used in interpretation of historic and prehistoric areas, and with the interagency archeological salvage program. Both have already been exhibited at important gatherings and have received most favorable comment.

Television.—Though there is a tremendous amount of usable subject-matter in the national parks and other areas administered by the Service, the means of reaching the public with it, via television, scarcely exist. Yet interpretive staffs have participated in effective fashion on several occasions. The important historical program under way at Independence National Historical Park Project has received frequent attention in the television programs of the Philadelphia public-school system, and a number of telecasts have featured distinguished visitors at Independence Hall. Philadelphia stations have also treated the Battle of Gettysburg and the Service's interpretive work there. Edward R. Murrow recently drew attention to Statue of Liberty National Monument in his national program, "See It Now."

Celebrations and Pageants.—Several colorful pageants and celebrations were held in historical areas during the year. The dedication of Grand Portage National Historic Site, Minn., last August 9, was participated in by United States and Canadian diplomatic representatives, and by representatives of the Minnesota Chippewa Indian Tribal Council, the Bureau of Indian Affairs, the Minnesota Historical Society, and the National Park Service. With the Ocmulgee Auxiliary Corporation, a group interested in aiding with the development and interpretation of Ocmulgee National Monument, as sponsor, the completion of the Ocmulgee museum was observed on November 2. Construction of the modern-style museum was started in 1938 but was halted by the war. Funds for its completion were appropriated by Congress in 1950. Col. B. C. W. Custer, descendant of Gen. George A. Custer, brought to Appomattox Court House National Historical Monument a flag of truce and a Virginia State battle flag which had figured in the closing battle of the Civil War. Their return was the occasion of brief and colorful ceremonies. The flags came from the Custer Collection, willed to the National Park Service by General Custer's widow. Items from that collection occupy a prominent position among the exhibits in the museum at Custer Battlefield National Monument, which was dedicated before a distinguished gathering on June 25—the 76th anniversary of the Battle of the Little Big Horn. The Tennessee Historical Society, other patriotic organizations, and Service representatives participated in ceremonies commemorating the 90th anniversary of the Battle of Shiloh on April 6 and 7. Anniversary ceremonies were also held at Moores Creek National Military Park, the Lincoln Museum, and at Dorchester Heights National Historic Site.

With Service approval, a pageant of the Revolution, entitled "Then Conquer We Must," was first performed at Kings Mountain National Military Park last October. Its second season began on June 15. The Hiawatha Pageant was also offered with great success at Pipestone National Monument on August 3, under the auspices of the Pipestone Exchange Club.

THE LAND PROGRAM

The land program of the National Park Service is long range and one directed at the ultimate acquisition of all lands situated within the approved boundaries of areas of the National Park System. Though notable progress was made during the year, this work was seriously handicapped by the loss of personal services as a result of appropriation-act riders.

Purchases.—The most extensive transaction involving the purchase of lands in an already established area has been the determination of condemnation awards for extensive holdings in Everglades National Park. Condemnation trials were divided into five groups; awards have been made in four of these. By the end of the year, approximately $1,600,000 had been expended or obligated for the acquisition of about 390,000 acres. All lands within the park are owned by the United States by virtue of a declaration of taking, filed in December 1950, on 125,000 acres involved in the five groups of cases mentioned above. It is proposed to expend the balance of the $2,000,000 donated by the State of Florida for Everglades land acquisition for purchases within the authorized park extension.

To alleviate the acute personnel housing shortage at Great Smoky Mountains National Park, the Service purchased a life estate in 102 acres on which are several good houses and other usable buildings. Important parcels were acquired or optioned in Glacier and Rocky Mountain National Parks; two critically important lots in Colonial National Historical Park were acquired by declaration of taking. A 1.8-acre parcel, on which part of the site of the old fort is situated, was bought with National Park Trust and donated funds at Fort Raleigh Historic Site.

A major transaction, not involving lands, was the purchase of the Rainier National Park Co.'s facilities for $300,000.

Settlements were reached, by stipulation or court judgments, on 17 parcels in connection with the declaration of taking on 27 parcels of land in the Independence National Historical Park Project, filed on March 1, 1951. A second declaration was filed on 12 parcels on December 12, 1951. For the first group, $791,600 was deposited with the court; for the second, including the 12-story Drexel Building, $1,224,500 was deposited. Use and occupancy agreements with several defendants in the first group, for periods up to 5 years, have reduced the costs of acquisition materially. No settlement in the second group had been reached at the end of the year.

On this project, for which Congress had authorized and appropriated $4,435,000, options in excess of $1,000,000 have been accepted. Negotiated acquisitions costing approximately $400,000 have been completed. Total obligations, plus a small reserve fund, approach closely the total appropriated. An increase of authorization to $7,700,000 has been approved; an appropriation under the increased authorization is the next step toward acquiring the rest of the lands in the project.

Title to the approximately 110 acres authorized for inclusion in the Fort Caroline National Historical Park Project has been acquired through declaration of taking. Estimated just compensation of $44,135 has been paid into court.

Since negotiations for purchase of the Old Stone House, in Washington, D. C., within the $90,000 appropriated for it were unsuccessful, condemnation proceedings have been instituted.

Donations.—Donations of $618,000 were made by the Avalon Foundation and the Old Dominion Foundation to match an equal amount provided by the State of North Carolina for the purchase of the lands within the boundaries authorized for the establishment of the Cape Hatteras National Seashore Recreational Area in North Carolina. The

Old Dominion Foundation is a Virginia charitable and educational foundation created by Paul Mellon, and the Avalon Foundation is a Delaware charitable trust established by Mrs. Ailsa Mellon Bruce. It was the interest of these foundations in conservation that moved them to make these generous donations. The Cape Hatteras project was authorized by act of Congress approved August 17, 1937. The National Park Service, through a land acquisition office at Manteo, N. C., will conduct the negotiations for the purchases to be made with the total fund of $1,236,000. When completed, the Cape Hatteras National Seashore Recreational Area will contain approximately 30,000 acres of unspoiled beach, the most extensive stretch of undeveloped seashore remaining on the Atlantic Coast. The Avalon and Old Dominion Foundations and the State of North Carolina, through their generous contributions, have done a great service both for the people of North Carolina and of the whole country.

Linville Falls has long been famed as one of the loveliest in western North Carolina, and public ownership has been urged for it for many years. Last winter, John D. Rockefeller, Jr., added another to his long list of benefactions to the National Park System by donating $95,000 for the purchase of the falls and Linville Gorge, 1,100 acres in all, most of it for addition to the Blue Ridge Parkway. In addition, Jackson Hole Preserve, Inc., donated 800 acres for inclusion in Grand Teton National Park, to which it had previously donated some 35,000 acres.

Through the generosity of Congressman Charles E. Bennett of Florida and numerous friends of the project, funds in the amount of $40,199 were donated to match an equal amount of appropriated funds toward the acquisition of lands associated with historic Fort Caroline, site of the French Huguenot colony which settled on the St. Johns River in Florida in 1564. A portion of the gift will be used to conduct an archeological investigation of the site.

The Commonwealth of Virginia donated nearly 600 acres of land for addition to the Blue Ridge Parkway, and the State of Mississippi 400 for the Natchez Trace Parkway.

The Collier Corp. donated to the State of Florida 35,000 acres of land north and northwest of Everglades National Park for eventual addition to the park.

The State of West Virginia, with a $350,000 appropriation, began acquiring approximately 500 acres for the Harpers Ferry National Monument project. It is understood that Maryland has available funds with which to buy about 900 acres, that State's portion of the proposed monument.

Space is lacking in this report to acknowledge individually the numerous gifts to the United States from public-spirited citizens which have greatly benefited the National Park Service during the course of the year. These include donations of museum pieces, antique furnishings for historic houses, books, manuscripts, and funds for important phases of National Park Service work. To all who have contributed, the National Park Service expresses its thanks.

Exchanges.—Approximately 2,000 acres of North Dakota Historical Society lands and 700 acres privately owned, all in Theodore Roosevelt National Memorial Park, were acquired by exchange. In the same area, pending are exchanges for 3,600 acres of university and school lands and 2,850 acres privately owned. Some 30,000 acres, owned chiefly by the Southern Pacific Railroad Co., in Joshua Tree National Monument, were also obtained by exchange. The State of Montana has made selections of lands it wishes to obtain in exchange for some 9,300 acres in Glacier National Park. In Olympic National Park, about 75 acres, chiefly resort properties, have been obtained by exchange for windthrown and other salvable down timber in the park.

Transfers.—The Forest Service transferred approximately 420 acres to the Blue Ridge Parkway. Also, about 10 acres were transferred from the Veterans' Administration for addition to Mound City Group National Monument. Through Presidential proclamations, Hovenweep National Monument was enlarged by 160 acres; Death Valley National Monument by 40 acres; and Sitka National Monument by 1 acre.

Rivers in Mammoth Cave.—An investigation was made at Mammoth Cave to ascertain what further studies are needed to determine (1) how to stop or control the sedimentation in river sections of Mammoth Cave and (2) what would constitute damage to the park by construction of the proposed Mining City Dam. It was determined that more flow and water-stage records at points in the Cave and on the Green River would have to be obtained for a number of years, and that better knowledge of the source of the Cave streams and sediment was needed. The matter has been referred to the Geological Survey.

Defense Uses of Park Areas.—At the end of the year, there were 51 national defense program types of permits in effect on areas under National Park Service administration, including 11 continued from World War II. Perhaps the most important issued during the year was one for an Atomic Energy Commission program to seek and remove uranium-bearing ore from Capitol Reef National Monument, declared vital to the defense program.

THOSE WHO VISIT THE PARKS

The period of heavy use of the areas administered by the Service is beginning earlier and ending later; visitor totals continue to increase rapidly, reaching 36,708,494 during the last travel year. At the same time receipts from fees do not increase proportionately. This is primarily attributable to the fact that there have not been enough employees to handle collections during the longer period of heavy visitation. Increased fee income would undoubtedly exceed the cost of employing additional personnel.

Travel Surveys.—The sharp growth of the tourist industry in recent years has begun to attract the attention of the business analysts. Numerous public and private agencies concerned with tourism are interested in obtaining accurate and complete information on pleasure travel and its economic influence. Areas of the National Park System and increased use of public highways occupy prominent spots in the travel picture. As a result of the increasing motor travel, the cooperation of the Bureau of Public Roads and certain State highway departments has been obtained in conducting travel surveys in several parks. Present efforts are being directed toward making a 12-month survey of a representative national park in each geographic region of the country. The ultimate objective is a survey of each type of area so that information applicable to all areas of the System will be available.

The Montana State Highway Commission conducted a tourist survey at Glacier National Park during the summer of 1951 and has published a report of the findings. The Virginia Department of Highways launched a survey at Shenandoah last January—the first national park travel survey to sample travel for each season. Plans are now being completed for a survey of travel to Yosemite National Park. These studies are being conducted in cooperation with the Bureau of Public Roads. The published report, *Crater Lake National Park and Oregon Caves National Monument Vacation Study*, was released during the year. That study was conducted by the National Park Service during the summer of 1950.

COOPERATIVE ACTIVITIES

History and Archeology.—Cooperation between the Service and the State of Washington in the field of historical archeology was perhaps the most noteworthy activity in the Federal-State cooperative program. Experienced Park Service personnel, whose work was financed by the Washington State Park and Recreation Commission, continued explorations at the site of Spokane House. The two reports written by the archeologist in charge reveal that such excavations have greatly increased knowledge of this important pioneer fur-trading post. It is expected to complete the Spokane House excavation this summer and to excavate the site of Fort Okanogan, another fur-trade center. Consultant service has also been given to the State concerning several of its historical park areas, actual or proposed, a significant extension of the cooperation given in the State park field for the past 16 years.

A number of agencies sought and received assistance on technical problems of a military-historical nature, and on interpretive planning and development. Ohio sought advice on planning the proposed Anthony Wayne Parkway and the State of Washington asked for help in preparing a tripartite agreement for the preservation and interpretation of Fort Simcoe.

State Cooperation.—For the first time, the Service has had a representative in each region assigned to State cooperation throughout the fiscal year. It was thus able to give increased assistance to State park agencies, the National Conference on State Parks, and other agencies. *State Parks—Areas, Acreages and Accommodations* was issued—the first revision since 1946.

Territorial Cooperation.—In connection with the Alaska recreation resources survey, the University of Washington is conducting a tourist survey of the territory; the National Recreation Association, a study of recreation facilities and programs in Alaska towns. This work is being done under contract with the Service. The Office of Naval Research is also helping on a survey of wilderness areas in northeastern Alaska. The University of Alaska will probably participate in an archeological survey of part of the Alaska Peninsula. The Geological Survey, Fish and Wildlife Service, Office of Territories, and others have extended valuable cooperation.

Reference is made elsewhere to cooperation affecting the Trust Territories.

River Basin Studies.—The trend in the Service's participation in river basin studies has been toward a more truly basin-wide approach. Contracts were made with the National Recreation Association to assist in the New England-New York regional survey and in the Arkansas-White-Red River survey, and with Iowa State College to assist in part of the Missouri River Basin survey.

A River Basin Studies and State Cooperation Conference was held at Lake Mead in May. Representatives of the Service's regional and district offices, the Colorado Great Basin Field Committee, the Program Staff, and Assistant Secretary Doty's office participated.

Reservoir Recreation.—Upon approval of a cooperative agreement between the Service and the Bureau of Reclamation, the Shadow Mountain National Recreation Area was established late in June, with the Service undertaking responsibility for development and management of recreation facilities and use there. Progress was made in negotiating agreements with State and local agencies for management of reservoir recreation areas not of national significance. Recreation area regulations were revised and simplified during the year.

IN THE FISCAL FIELD

Amendments to the 1952 appropriation acts, which set both position and monetary limits for personal services, required, for the Service as for other agencies, the establishment and supervision of controls which made heavy additional demands on the time of fiscal staffs while forcing reductions in fiscal personnel. In the Fiscal Division in the Washington office, the 45 budgeted positions were reduced to 35 by the end of the year.

The 2-month delay in passage of the 1952 Interior Department Appropriation Act added greatly to financial uncertainties throughout the Service. The monetary limitation on the amount of funds expendible for personal services for the Washington office was set at 90 percent of the budget estimates, retroactive to the beginning of the fiscal year. Consequently, it was necessary to cut employment for the 10 months remaining after passage of the act below the 90 percent level, to offset the 100 percent employment during the first part of the year and in order that the reduction might be made by leaving vacancies unfilled rather than by reduction-in-force procedures. The problem of keeping within the monetary limitation for personal services was sharpened by the necessity of making several large lump-sum terminal leave payments.

Equipment Amortization.—The program of equipment amortization recently adopted by the Service has been an outstanding success. In the past, it has been necessary to justify automotive equipment needs as nonrecurring amounts in the annual budget estimate; they could not be included in the appropriation base and were frequently lost during the budget processes. Hence the Service found itself with an automotive fleet mostly of old, worn-out vehicles, retained far beyond their economical life, and extremely costly to keep in repair. The amortization program eliminates those handicaps; it pools all equipment and assigns it to programs or projects to effect the most advantageous use of it. It also results in far better accounting, spreading the cost of the vehicles at established mileage or hourly depreciation rates to the various operations and activities on the basis of actual use. And equipment replacement funds are now included in the appropriation base, not needing to be justified as nonrecurring items.

Decentralization of Fiscal Authority.—In line with Departmental policy, the first step was taken in decentralizing, to the regional offices, certain budget-execution functions, for the following appropriation activities: Management of park and other areas, buildings and utilities, etc. (maintenance and operation); and buildings and utilities, etc. (construction). This was the first step in ultimate decentralization to the regional offices of budget execution functions for all appropriation activities at regional and field levels. It has many advantages, arising chiefly from the nearness to the scene of operations of the regional directors and their staffs and their more intimate knowledge of field problems and needs. Necessary actions and adustments are expedited; time and paper work are saved; and better working relationships are promoted.

CONCESSIONS SITUATION SHOWS IMPROVEMENT

Having a well-defined and generally acceptable policy under which to work, the Service has made heartening progress in perfecting contracts for the operation of concessions of many kinds since the Department approved the present policy about a year and a half ago. Most contracts approved or under negotiation require the concessioners to expend, as part of the payment for the privilege of conducting operations in the parks, a percentage of their gross receipts to provide facilities that will result in better and additional public accommodations. All improvements so built are the property of the Government.

Contract Progress.—The Service has entered into 14 new concession contracts; preliminary negotiations have been completed on 15 others and started on 5 more. Sixteen contracts have been extended to give further time for negotiations or for study of operating or development problems which must be resolved before new contracts can be prepared. Twenty subconcession agreements for various services have been approved.

Agreement was reached with a number of concessioners on short-range expansion and improvement programs to be undertaken in the next 3 to 5 years. A majority of the contracts provide for a flat franchise fee plus percentages of gross receipts which vary with the character and conditions of operation.

Approved contracts include the following: S. G. Loeffler Co., and Government Services, Inc., National Capital Parks; Glacier Park Transport Co., Glacier National Park; Lassen National Park Co., Lassen Volcanic National Park; Fred Faver, Lake Mead National Recreation Area; Viola N. Montgomery, Muir Woods National Monument; Emery C. Kolb and Babbitt Brothers Trading Co., Grand Canyon National Park; Hot Springs Mountain Observatory Co., and New Moody Hotel Co., Hot Springs National Park; Virginia Sky-Line Co., Shenandoah National Park; Sequoia and Kings Canyon National Parks Co., Sequoia and Kings Canyon National Parks; Haynes, Inc., Yellowstone National Park; and Cavern Supply Co., Carlsbad Caverns National Park. Contracts of major importance on which negotiations have been completed include Yosemite Park & Curry Co., Yosemite National Park; Kilauea Volcano House, Ltd., Hawaii National Park; Mrs. Evelyn Hill, Statue of Liberty National Monument, and Rocky Mountain Motor Co., Rocky Mountain National Park.

Rate Schedules.—Last August, the Office of Price Stabilization issued, at the Service's request, a regulation which permits it to continue its usual rate-approval procedure. Rates become effective 30 days after approval unless previously objected to by OPS. Negotiations are now in progress, looking to elimination of the 30-day waiting period.

Concessions Facilities.—Under the contract awarded to Fred Faver, for furnishing all public accommodations at the Katherine Wash site on Lake Mohave in the Lake Mead National Recreation Area, public requirements are being met currently. With first-quality planning and construction, there is promise of facilities of which concessioner and Service can be proud. * * * A new girls' dormitory at Lake, Yellowstone National Park, under construction last year by the Yellowstone Park Co., was ready for occupancy during the 1952 season. In the Lake Hotel, 53 rooms in the east wing were rehabilitated, and other accommodations and facilities were improved. * * * Water storage at Bryce Canyon National Park was increased 78 percent by construction of a 312,000-gallon tank by the Utah Parks Co.

The Yosemite Park & Curry Co. has completed Oak Cottage, a 32-room guest house, at Yosemite Lodge. The company is also completing a multiple housing unit for employees of the company and a company residence in the new Tecoya area. Heavy snows last winter caused the collapse of the west section of Big Trees Lodge and severe damage to the east wing.

The Virginia Sky-Line Co. completed and dedicated a new, thoroughly modern dining room at Skyland. It is also constructing a new lodge building in the Skyland area. * * * A notable new service was introduced at Everglades National Park with execution of a 5-year agreement for sightseeing boat operation.

Lack of adequate transportation continues to limit public use of Isle Royale National Park and forced National Park Concessions, Inc., to ask for authority to discontinue operations at Windigo Inn, Washington Harbor. This has the further effect of discouraging the development of small-boat service from Minnesota take-off points.

THE FORESTS OF THE NATIONAL PARK SYSTEM

During the calendar year 1951, for which the Service's record of forest fires is complete, 320 fires originated within the park boundaries or spread across boundaries from outside. Perhaps the most notable fact in this connection is that of the 165 man-caused fires that started inside, only 79 were reported as probably caused by nonlocal travelers, although the visitor total was the greatest ever. The problem of carelessness with fire by those resident near the parks needs particular attention.

Fire losses were reduced in all areas except Everglades National Park, where 96 percent of the total land area burned over is situated. There fire swept over 42,984 acres, of which 40,214 acres were grassland. The large fires in Everglades were caused by lightning, and 1951 was the first year in which lightning has been officially established as a cause of fire there. Though protection against fire has vastly improved since establishment of the park, it needs to be further strengthened both in and adjoining the park.

Fire control training and preparedness were materially strengthened during the year through more effective training techniques; by improved cooperation with other agencies; and by installation of a small smokejumper crew in Yellowstone National Park. Due to the wet season at Yellowstone, the effectiveness of this last arrangement was not put to a test.

Forest Insect Control.—Effective forest pest control was carried on in a number of areas. Maintenance control has been effective in keeping barkbeetle and defoliator losses to a minimum, in spite of inadequate funds from the control-of-forest-pests appropriation and the fact that the first allocation was not made to the Service until late October. All control of defoliators—insects that feed on the leaves or needles of trees—was performed on eight areas in the Southwest, by spraying insecticides either from mistblowers or from airplanes. A virus disease present in the needle-miner population gives hope that the lodgepole pine needle-miner epidemic in the Tenaya Lake area of Yosemite National Park, unchecked for several years, may soon be controlled. Increased activity by barkbeetles in areas adjacent to California national parks is a threat requiring watching, though it has been reduced to some extent by recent control measures on these adjacent areas. The spruce barkbeetle epidemic adjacent to Rocky Mountain National Park and the spruce budworm in Montana are also threats to be watched.

A highlight of the past fiscal year was the completion of the Teton-Targhee Mountain pine beetle control project. This project, started in 1947, cost the United States Forest Service and the National Park Service approximately $1,271,000. Its success ended the threat to more than 2 million acres of lodgepole pine in Shoshone National Forest and Yellowstone National Park.

White Pine Blister Rust Control.—Control of white pine blister rust was initiated by the National Park Service at Acadia National Park in 1921, and to date work has been undertaken on 361,330 acres in 13 national parks and 1 parkway. On about 55 percent of this acreage, control work now consists only of infrequent working. Initial work is completed on 301,665 acres. During the year, 2,081,712 ribes plants—currant or gooseberry, the alternate host of the disease—were eradicated in the 10 areas in which work was carried on.

Oak Wilt.—Although oak wilt, lethal to native oak species, has been found in widely scattered locations, Effigy Mounds National Monument, Iowa, is the only Service-administered area in which it has been discovered. Control efforts were started there in the spring of 1951 and continued this year. They involved removal of infected trees and isolating these infection centers from the rest of the oak stand. This isolation is accomplished by cutting or poisoning all oaks within 40 feet of the infected trees, as the only known means of transmission of the disease is by root grafts.

Ponderosa Pine Mistletoe Infestations.—Initial control work on the infestation of ponderosa pine mistletoe at Grand Canyon was completed during the past year, 3 years after it was initiated. This involved removal of all infection from the stand, either by pruning, poisoning, or removal of the infected trees. Last summer, representatives of the Division of Forest Pathology, after a survey, recommended control work similar to that at Grand Canyon on about 960 acres in the northern portion of Bryce Canyon National Park, where the mistletoe has caused considerable loss. Funds to launch this project were included in the 1953 fiscal year estimate.

Grazing.—Grazing records for the National Park System are maintained on a calendar-year basis. During 1951, 130 permits were authorized in the western areas for a total of 107,923 animal-unit months. After gradual annual reductions, domestic livestock grazing was terminated in Carlsbad Caverns National Park at the close of the calendar year.

Tree Preservation.—The six-man mobile tree-preservation crew, working in the North during the summer and in the South during the winter, continued its excellent work, providing tree maintenance in 21 areas in Region One. Except for Acadia and Mammoth Cave National Parks, where there are valuable shade trees at long-developed areas, all of the crew's work was in historical areas. Supplementing their work, funds were provided for contract spraying of elms at Vanderbilt Mansion, Home of Franklin D. Roosevelt, and Adams Mansion National Historic Sites and Morristown National Historical Park, to protect their trees from Dutch elm disease.

PERSONNEL MANAGEMENT

As was doubtless the case in many other agencies, the outstanding fact about personnel management in the Service during the past year has been the reduction in personnel and other restrictions resulting from amendments to 1952 appropriation acts. The Ferguson amendment caused drastic reductions in the administrative personnel of the Service, including the staff of the Personnel Division; the Jensen amendment required the keeping of records which complicated and tended to delay operations; the Whitten amendment to the Supplemental Appropriation Act of 1952 blocked many well-deserved promotions or delayed them for periods ranging from a few weeks to many months.

Promotion Policy.—The promotion policy of the Service was restated and brought up to date. Also, important changes were inaugurated in promotion lists and promotion procedures to give better assurance that all who deserve promotion will be considered when opportunities arise.

Advance in Training Program.—Addition of a training officer to the staff of the Personnel Division permitted stepping up the Service's training program considerably. It enabled the Division to assist in conducting two very successful personnel instruction courses, one in the Region Two office in January, the other in the Region Three office in April. These were attended by 54 outstanding field employees.

Other results have been the preparation and publication of an orientation booklet for field employees, and the preparation of a manual for use in training supervisors, expected to be issued early this year.

Delegations of Authority.—Noteworthy during the year were additional delegations of personnel authority to the Director and by him to the field. One of these gave the regional directors authority to establish appropriate pay rates for ungraded employees. Another permits field officials to make appointments and status changes in positions through Grade GS–9—two grades higher than previously. The Director was also authorized to approve collaborator appointments, without compensation. These delegations should considerably increase the speed of processing personnel actions and lead to increased efficiency of operation and better employee morale.

Occupational Studies.—Occupational studies for historical aides, guides, communications positions, and administrative officer positions were completed. The first two were undertaken in connection with the writing of specifications for such jobs. An occupational study of park superintendent positions has been started, as has a study of supervisory park ranger positions in Region One.

Personnel Changes.—Following are the principal promotions, transfers and retirements which have been effected during the year:

Retirements.—Washington: Arthur E. Demaray, director; John D. Coffman, chief forester; Frank A. Kittredge, chief engineer; C. D. Montieth, chief, Electrical Branch, Design and Construction Division; Burns C. Downey, chief, Rate Control Branch, concessions Management Division; C. Max Bauer, geologist, Natural History Division. Field: Charles J. (White Mountain) Smith, superintendent, Zion and Bryce Canyon National Parks; Ernest P. Leavett, superintendent, Crater Lake National Park; Max R. Wainwright, superintendent, Lehman Caves National Monument.

Transfers and promotions.—Washington: Conrad L. Wirth, from associate director to director; Thomas J. Allen, from regional director, Region One, to assistant director; Lawrence F. Cook, from assistant chief forester to chief forester; Paul McG. Miller, from chief, Minor Roads Branch to chief engineer, Design and Construction Division; Erwin H. Cort, first from rate analyst to chief, Business Analysis Branch, and then to chief, Rates Control Branch, Concessions Division; Frank H. Longfellow, from chief, Restaurant Branch, OPS, to chief, Business Analysis Branch, Concessions Division; Charles B. Foster, Harry M. Elsey, and Paul Pernecy, Jr., from business accountant, to chief, Field Audit Section, assistant chief, Financial Control Branch, and assistant chief, Commercial Audit Branch, respectively, Audit Division.

Field: Elbert Cox, from associate regional director to regional director, Region One; Daniel J. Tobin, from superintendent, Lassen Volcanic National Park, to assistant regional director, Region One; John C. Preston, from superintendent, Mount Rainier National Park, to superintendent, Great Smoky Mountains National Park; Preston P. Macy, from superintendent, Olympic National Park, to superintendent, Mount Rainier; Fred J. Overly, from chief, Real Estate Branch, Lands Division, to superintendent, Olympic; James W. Holland, from superintendent, Shiloh National Military Park, to regional historian, Region One; Ira B. Lykes, from manager, Prince William Forest Park, to superintendent, Shiloh; Charles E. Humberger, from chief ranger, Isle Royale National Park, to superintendent, Mount Rushmore National Memorial; Earl H. Semingsen from chief ranger, Everglades National Park, to superintendent, Wind Cave National Park; Fred T. Johnston, from assistant superintendent, Yellowstone National Park, to superintendent, Lassen Volcanic National Park; Warren F. Hamilton, from assistant superintendent, Natchez Trace Parkway, to assistant superintendent, Yellowstone; Curtis K. Skinner, from chief ranger, Yellowstone, to assistant superintendent, Mount Rainier; Harthon L. Bill, from assistant superintendent, Mount Rainier, to assistant superintendent, Yosemite National Park; John B. Wosky, from assistant superintendent, Yosemite, to superintendent, Crater Lake National Park.

Awards.—The Department of the Interior Distinguished Service Award was made to retiring Director Demaray, Chief Forester Coffman, and Chief Engineer Kittredge, and, posthumously, to the late Chief of Concessions Oliver G. Taylor, as well as to former Ranger Blake C. Vande Water. The Department's Conservation Service award went to Paul K. Petzoldt, for his heroic voluntary search, with Ranger Vande Water, for the New Tribes Mission plane which crashed on Mount Moran, Grand Teton National Park, in November 1950. Dr. Jesse L. Nusbaum, departmental archeologist, received an efficiency award under title X of the 1949 Classification Act.

LEGISLATION

Although Congress adjourned shortly after the beginning of the 1953 fiscal year without acting on several bills desired by the Service, a number of others were passed and approved. Appropriations to complete land acquisition at Independence National Historical Park Project, for the addition of land to Mound City Group National Monument, and for the acquisition of Gila Pueblo, near Globe, Ariz., for use as Southwestern National Monuments headquarters were authorized. Land exchanges were authorized at Death Valley and Badlands National Monuments. The Coronado International Memorial Act was revised to provide for establishment of a national memorial. Several measures will effect a saving for the Federal Government or improve administration. These include conveyance of Centre Hill Mansion at Petersburg National Military Park to the Petersburg Museum Corp.; conveyance of a road right-of-way in Acadia National Park to the town of Dedham, Maine; conveyance of surplus Blue Ridge Parkway lands to the Forest Service; authorization of maintenance and operation of acquired properties at Independence National Historical Park Project; and provision for the protection of scenic values along the Grand Canyon approach road.

LITIGATION

The case of *Peterson* v. *United States*, involving the question of Federal jurisdiction over private lands within Sequoia and Kings Canyon National Parks, was concluded in favor of the United States. Both the District Court and the Court of Appeals held that cession of exclusive jurisdiction from the State of California gave the United States power to regulate such lands. Petition for certiorari was denied by the Supreme Court.

The District Court for the Southern District of California found for the plaintiff in the suit brought against the United States by William L. Claypool under the Federal Tort Claims Act to recover damages for injuries resulting from an attack by a bear in Yellowstone National Park. Damages had not yet been awarded at the end of the year.

KEEPING THE OWNERS INFORMED

The provision of information about its activities and its policies is a function which the public has a right to expect of any Government agency. It may be performed in a great variety of ways. A basic obligation is to give the facts as honestly and straightforwardly as possible, and to avoid propaganda which relies on concealment or distortion.

Dealing directly with millions of joint owners of the properties it manages, the Service must meet extraordinarily heavy demands for information. And since accurate printed informational material is essential to both enjoyment and protection of the parks, one of its most necessary tasks is the production of numerous publications.

All of this is work for trained personnel; not something which the administrator can undertake as a sideline. The Service has no information personnel in its regional offices; hence, much work of kinds that other agencies perform in the field must be done by the small Washington office information staff. Never large enough to undertake more than a part of the legitimate functions which might be performed, this staff was reduced from 11 to 8 employees as a result of an amendment to the 1952 Appropriation Act. This severely handicapped the performance of legitimate functions.

Publications.—For every four visitors in 1941, there were seven in 1951. Today's printing dollar will probably not buy half as much as that of 1941. Yet there are fewer dollars for production of informational literature than in 1941. This fact compels the most rigid economies—reductions in size and content of publications, and careful, almost niggardly distribution procedures. Visitors are handicapped in not receiving information to which they are entitled and that is needed for their protection and the protection of the areas.

During the year, 6,807,000 pieces of free informational literature were requisitioned—less than one to every five visitors. Thousands of these were supplied to meet requests received by the Washington and field offices. In addition, there were issued four more items in the historical handbook series—for Shiloh and Petersburg National Military Parks and Fort Sumter and Statue of Liberty National Monuments. Projected, though none has yet been issued, is a series of natural history handbooks. Also, another series of modest booklets is planned, to acquaint the public with various phases of the Service's work. The first of these should appear during the 1953 fiscal year.

Press Releases.—Most field areas issue occasional press releases to nearby newspapers. In the Washington office, their preparation is a very minor phase of informational activity. Those which are issued deal factually with matters of legitimate news and, in accordance with the law, are sent only to publications or persons who have requested them.

Motion Pictures.—After inviting competitive bids, the Service awarded a contract to Encyclopedia Britannica Films, Inc., to revise and distribute the Atwater Kent Foundation-Ted Phillips film of Yosemite National Park, a gift to the Service in 1949. The purpose is to assure the widest possible distribution of this fine picture. The United States Treasury will receive a royalty on all copies sold. This spring, Mr. Phillips has been taking footage for a film, for General Petroleum Corp., to tell the Grand Canyon story, something in which the Service has made numerous efforts to interest motion-picture companies.

Yellowstone, Wind Cave, and Everglades staffs cooperated with the Walt Disney studios in connection with the shooting of footage for three of the True Life Adventure Series which have done so much to waken Americans to the wonders of Nature. "The Olympic Elk," one of this series taken in Olympic National Park, was released during the year.

THE PARKS OF THE NATION'S CAPITAL

The National Capital Parks, which together have the status of a field area of the National Park System, present problems and are the locale of events which differ materially from those of other areas administered by the Service. The sense of proprietorship felt toward the capital city by Americans everywhere extends to these parks; as many major events of the year indicate, they are something more than a metropolitan park system.

Memorial Bridge Equestrian Statues.—Fulfillment of efforts to complete the ornamentation of the District of Columbia approaches to the Arlington Memorial Bridge was marked by ceremonies last September when four heroic equestrian statues were dedicated on the Memorial Bridge Plaza. The statues had been cast in Italy as a gift to the people of the United States from the people of Italy. The President of the United States and His Excellency Alcide de Gasperi, Prime Minister of Italy, participated in the ceremonies.

The White House.—Prior to reoccupancy of the White House in March, after renovation, the Office of National Capital Parks restored and improved the lawn areas surrounding the Executive Mansion. Temporary buildings erected in connection with the restoration work were removed. Other work included a major planting of boxwood on the north grounds, replanting of the east and west gardens on the south side of the mansion, introduction of an azalea garden, moving and planting several large trees, and resodding of approximately 4 acres of lawn.

Mahatma Gandhi Memorial.—The National Commission of Fine Arts approved a site, not to exceed 6 acres, in Barnard Hill Park for the Mahatma Gandhi Memorial, in accordance with an act of the Eighty-first Congress. The India League of America, sponsors of the memorial, plan to erect a memorial building containing an auditorium, library, and museum.

The Netherlands Gift.—On April 4, Queen Juliana of the Netherlands, at ceremonies held in Meridian Hill Park, made a token presentation of a 32-bell carillon to the people of the United States in behalf of the people of the Netherlands. The gift was accepted by the President of the United States. The permanent carillon of 49 bells is now being cast in the Netherlands. A permanent site for the bells has not yet been chosen.

A New Park, and Other Matters.—By transfer from the Department of Agriculture, Blue Pond Park was added to the National Capital Parks system. In its 380 acres, a stream valley and lake give it good park development possibilities. Lying north of the National Agricultural Research Center, it is within a mile of the Baltimore-Washington Parkway. * * * Preliminary steps have been taken for transfer of complete control of the Carter Barron Amphitheater, in Rock Creek Park, from the Sesquicentennial Commission to National Capital Parks. A fund of $200,000 from the Commission's appropriation, to be used to complete the facility, was also authorized. * * * National Capital Parks and the Trees and Parking Division of the District of Columbia government, working jointly, discovered 470 cases of Dutch elm disease in the District during 1951; 65 were on park lands. The use of DDT spray and removal of infected trees continue to be the principal methods of control. Though the number of diseased trees has increased rapidly since the first was discovered in 1947, the horticultural staff predicts a decrease in 1952.

STORM, SNOW, AND FLOOD

On September 1, 1951, a cloudburst caused one of the most severe flash floods in the history of the Great Smoky Mountains. The Newfound Gap Highway was washed out in five places, and completely destroyed in two. The Alum Cave trail to Mount LeConte was demolished. There were extensive landslides on the slopes of Mount

LeConte. Both bridges into the Sugarlands maintenance area were washed out and had to be repaired before road-repair equipment could be taken out. The Jim Carr Grist Mill, of great interest to visitors, was washed away. Much other damage was done. Miraculously, no park visitors were injured. The Newfound Gap Road, opened for through travel 8 days after the flood, is now being completely repaired. Additional severe damage was caused by rain and wind on three occasions during March.

The Cascade Mountain, Sierra Nevada, and Rocky Mountain regions all had extraordinarily heavy snowfall last winter. At Lassen Volcanic National Park, 224 inches of snow piled up during a 28-day period. Mesa Verde had a winter of record severity. At Badger Pass, in Yosemite, the snow depth reached 17 feet. Snowfall in Sequoia and Kings Canyon exceeded all previous records. On March 20, the depth at Crater Lake headquarters was 221 inches, also a new record. The snow pack and water content in the higher elevations at Rocky Mountain exceeded all previous records.

The National Park Service was put to more than usual expense in keeping park roads open in the areas of heavy snow. Though much energy was expended—at considerable cost—on removing snow from roofs, many Park Service and concessioner structures suffered serious damage.

Rain-makers claim credit for the greatly increased amount of rainfall and snowfall in southern Utah, the effects of which were highly beneficial to Bryce Canyon and Zion National Parks. Increased precipitation throughout much of the Southwest after a long and severe drouth resulted in extraordinarily fine displays of spring flowers in many of the southwestern areas administered by the National Park Service.

NOTES OF INTEREST

Kilauea Erupts.—The 18-year quiescense of Halemaumau, Kilauea Volcano fire-pit, was broken near midnight, June 27. The start of the eruption produced a molten fountain of lava 700 feet high. The eruption fissure, extending northeast-southwest across the fire-pit floor, became a curtain of fire; lava fountains played along its 3,000-foot length to a height of 400 feet. Within 30 minutes after the eruption began, the whole crater floor was a seething, boiling cauldron.

In the first 2½ days, 51,360 visitors were recorded. They posed serious traffic and safety problems. A predeveloped traffic pattern and highway sign program was put in operation immediately; successfully, too, since 70,000 visitors (up to June 30) came and saw without an accident. Most visitors came after dark, since the eruption showed up most spectacularly in the black of night.

Though a barricade was promptly established 10 feet back from the rim of Kilauea Crater, an acute safety problem developed because of the huge cracks behind spectators' vantage points. An elevated steel ramp, away from the unstable rim, has been suggested as a means of meeting this problem, likely to recur at any time.

River Trips in Dinosaur.—The controversy over Dinosaur National Monument dams has focused much public attention on that area. Many persons interested in determining for themselves the quality of the area have visited and explored it, including the taking of boat trips down the Green and Yampa canyons. Forty-five persons made such trips in the 1951 fiscal year, and approximately 120 in 1952.

Work done during the year now enables motorists to drive to Harpers Corner, offering a splendid view of the confluence of the rivers; the road to Pats Hole is also being improved.

Park Visitor Fatalities.—During the calendar year 1951 there were 42 visitor accident fatalities—1.13 per million visitors. Motor vehicle accidents took a toll of 23 lives, drownings 16, falls 2, and lightning 1. There were no mountain climbing fatalities.

Airplane Crashes.—The wreckage of a C–47 Air Force plane was discovered in Lassen Volcanic National Park on May 30. It was identified as one which had been en route from Spokane, Wash., to Travis Air Force Base on December 26, 1951. Army officials identified the bodies of three crew members and five military passengers. * * * A military plane crashed into the side of Mount Crillion, Glacier Bay National Monument, at about the 10,000-foot level on July 20, 1951, killing all on board. Because of the hazardous conditions, no attempt was made to remove the bodies.

SAFEGUARDING SPECIAL RESOURCES OF FEDERAL LANDS

Historical, archeological, and paleontological field research on lands under Interior Department jurisdiction may be undertaken only under permit issued by the Secretary of the Interior—a requirement of the Antiquities Act of 1906. It is, as it was intended to be, a major safeguard against "pothunting" and against the conduct of research by persons or groups not qualified to undertake it. Investigations of research projects and of the qualifications of those proposing to conduct them, in advance of permit issuance, are the responsibility of Departmental Archeologist Jesse L. Nusbaum, headquartered at the Region Three office of the National Park Service, in Santa Fe, N. Mex.

The increasingly high cost of conducting such research is the principal reason for a slight drop in number of projects during the 1952 fiscal year. There were 28 applications for Antiquities Act permits. One applicant was denied a permit for lack of qualification and, subsequently, multiple violations in anticipation of receiving a permit were investigated and confirmed by the Bureau of Land Management.

Field work was continued during the year under previously issued permits; on 14 projects work was resumed under permit renewal or was initiated under new permit on 24 projects. Two archeological and nine paleontological programs were conducted in Big Bend, Everglades, Glacier, and Zion National Parks, and Arches, Badlands, Capitol Reef, Canyon de Chelly, Death Valley (four projects), Petrified Forest, and Rainbow Bridge National Monuments.

Participating in this active program were the Universities of Alaska, California, Colorado, Florida, Harvard, Michigan, Oregon, Southern California, Stanford, Texas, and Utah; museums included American Museum of Natural History, Arizona State, Frick Laboratory of the American Museum, Museum of New Mexico, National Museum of Canada, Peabody Museum of Harvard, and the Southwest Museum. Dr. Nusbaum has carried on such field inspections as funds would permit to assure conformity with permit requirements and approved field methods. There has also been constant effort to educate the public on the necessity of safeguarding surviving antiquities against damage or loss through pothunting, unscientific excavation and, in a wholesale scale, use of huge earth-moving equipment. Pending decision is Dr. Nusbaum's request that the West Coast Pipeline Co. meet the cost of archeological survey and salvage excavation on Interior lands along the right-of-way of its projected 1,100-mile pipeline from West Texas to near Los Angeles.

Increases in population and industrial development in hitherto relatively isolated areas bring with them threats to the protection of rich archeological treasures, as, for example, in the San Juan Basin.

Cooperation with Canada.—Dr. Nusbaum, at the request of Canadian archeological authorities, advised them regarding the adoption in Canada of legislation similar to our 1906 Antiquities Act. His recent experience in salvage archeology in connection with construction of fuel pipelines was also made available to Canadian authorities for similar operations in Western Canada.

BUREAU OF INDIAN AFFAIRS

Dillon S. Myer, Commissioner

Greatly increased emphasis on the ultimate transfer of Indian Bureau function either to the Indians themselves or to appropriate State and local agencies was reflected during the fiscal year 1952 in almost every phase of the program of the Bureau of Indian Affairs.

One of the outstanding developments was the establishment of a new Division of Program in the Central Office of the Bureau. The prime function of the new Division is to stimulate, guide and assist the development of joint programing by tribal leaders and Bureau personnel looking toward improvement of the basic economic status of Indians and step-by-step withdrawal of the Bureau from their affairs. Toward this end, staff personnel of the Division visited a large number of Indian areas, consulted with Bureau field personnel and tribal leaders and addressed numerous Indian community meetings on the subject of program development. The result was to bring the centrally important programing work of the Bureau into much sharper focus and to lay the groundwork for more tangible progress in the direction of actual Bureau withdrawal from tribal affairs.

Another development of major significance was the introduction in Congress of bills sponsored by the Bureau and the Department which would provide the authority necessary for complete Bureau withdrawal from the State of California (S. 3005, H. R. 7490, H. R. 7491) and from the area of western Oregon formerly under the jurisdiction of the Grand Ronde-Siletz Agency (S. 3004, H. R. 7489). Before the bills were introduced, Bureau field personnel held extensive consultations with the various Indian groups which would be affected and with key officials of the two States. Because of the many complex land and water problems involving the Indians of California, it was anticipated that the effectuation of complete Bureau withdrawal would require from 3 to 5 years after enactment of the authorizing legislation. Among the 41 bands of the Grand Ronde-Siletz area, it was expected that after enactment of the legislation the job of withdrawal could be completed within a year. While none of the bills was enacted prior to congressional adjournment, committee hearings were held and witnesses heard in both the Senate and the House of Representatives.

As part of the general pattern of withdrawal activities, the Bureau took additional steps during the year to accelerate the transfer of responsibilities for educating Indian children t othe regular public-school system of the country. In a number of areas, where there are both Indian and non-Indian children to be educated, public schools and Indian Service schools were merged under a plan of pooled resources and joint responsibility for operations. In other areas, where the school-age population is almost exclusively Indian, consultations were held with local school districts or with State educational officials looking to the outright transfer of responsibilities for the operation of Indian Service schools. Plans for transferring 25 Indian Service schools on this basis were developed before the close of the fiscal year and were expected to be consummated during fiscal year 1953. At the close of the year the Bureau had contracts providing for the education of Indian children with 14 State departments of education and 27 local school districts. One major new contract was consummated during the fiscal year with the Territory of Alaska.

Similar activities were carried on looking to the transfer of responsibilities for the protection of Indian health from the Bureau to appropriate State or local agencies. While no transfers of Indian Service hospitals were accomplished during the year, basic authority for such transfers was provided by enactment of Public Law 291 which was approved April 3, 1952. This act also authorized the admittance of non-Indians as patients in Indian Service hospitals in areas where other hospital facilities are not available.

In presenting its appropriation estimates for the fiscal year 1953, the Bureau requested funds to be used specifically for contracting under the Johnson-O'Malley Act with non-Federal hospitals for the care and treatment of tubercular Indians, particularly Navajos. It was hoped that a total of 400 beds in various hospitals throughout the country could be provided in fiscal year 1953 as one important means of relieving the serious tuberculosis problem on the Navajo Reservation. The Bureau also continued its contracting with States under the Johnson-O'Malley Act for provision of public health and preventive medical services to the Indians by the county health departments. At the close of the year the Bureau had 30 contracts of this kind in effect with States, counties, or local health units.

In the field of law enforcement the Bureau conducted numerous negotiations with various tribal groups and with State authorities looking toward a transfer of jurisdictional responsibilities within

Indian reservations from the Federal Government to the States. Bureau-sponsored bills were introduced in Congress providing for a transfer of Indian civil and criminal jurisdiction to the States of Minnesota, Wisconsin, Nebraska, California, Oregon, and Washington. Although none of these bills were enacted, committee hearings were held on several and one (the California transfer bill) was passed by the House of Representatives.

The 10-year rehabilitation program for the Navajo and Hopi Tribes, which was initiated in the fiscal year 1951, moved forward on many fronts during its second year of operations. Construction projects to improve and expand the school facilities were launched and carried forward at seven key locations on the Navajo Reservation. These included six conversions of existing day schools to accommodate boarding students and construction of a large new boarding school at Shiprock, N. Mex., designed for 750 pupils. Work was also advanced on projects designed to improve the basic health installations, to enlarge the existing irrigation facilities, to achieve better conservation of soil and moisture resources, and to bring about better transportation and communication systems in the Navajo-Hopi area. Arrangements were made for a basic survey of mineral resources covering a substantial part of the reservation area to be conducted during the summer of 1952 by the Universities of Arizona and New Mexico. Prospects for further progress under the long-range program were encouraging since a total of $9,259,000 was made available for the program under the Bureau's appropriation for the fiscal year 1953 as compared with $8,645,520 in 1951 and $6,675,100 for 1952. At the same time, however, it was becoming increasingly apparent that, because of inflationary factors, the full program contemplated when Public Law 474 of the Eighty-first Congress was enacted could not be carried out with the $88,570,000 authorized by that act.

Leasing of Indian lands for oil and gas production reached an all-time high during the fiscal year. Activity of this kind was especially pronounced at the Fort Peck Reservation in Montana, at several of the Sioux reservations in North and South Dakota, and at the Ute Mountain, Southern Ute, Jicarilla Apache, and Navajo reservation areas in southwestern Colorado and northwestern New Mexico. Altogether approximately 600,000 acres of Indian lands were leased for oil and gas production in fiscal 1952 compared with approximately 400,000 acres the previous year. The amount received by Indians in bonuses as compensation for the signing of oil and gas leases almost doubled, increasing from less than $4,000,000 in fiscal 1951 to more than $7,000,000 in 1952. The total income realized by Indians from such leases in the form of bonuses, royalties, and rentals rose from approximately $13,000,000 in 1951 to more than $15,000,000 in 1952.

As another part of the general movement toward withdrawal of Bureau supervision and services, intensive efforts were made during the year to encourage Indians to seek loans from banks and other types of credit institutions rather than from the Bureau. An important move in this direction was the modificaion of the regulations governing Indian trust land so as to permit the mortgaging of such lands under certain prescribed conditions. As a result of this change, Indians owning allotted land were put in position for the first time to borrow from the private and public sources on a basis of equality with other citizens. A survey of Indian borrowing conducted during the year showed that in 1951 Indians received nearly $20,000,000 of credit from non-Bureau sources that could be accounted for and the actual amount was probably much greater. The total amount of Bureau loans of all types outstanding on June 30, 1951, was approximately $24,000,000.

In the field of administrative management there were two developments of major importance. One was the work accomplished by a property survey team from the Bureau's Central Office which visited 5 of the Bureau's 11 area offices during the year and colloborated with the area staffs in completing an inventory of all movable property on hand, installing new procedures for controlled procurement and property management, and disposing of all unserviceable and obsolete property and scrap. The other was a movement to establish personnel classification officers in each of the Bureau's area offices in order to decentralize the large amount of classification work previously performed in the Central Office. By the end of the fiscal year, classification positions had been established in six of the area offices and filled in four.

PROGRAM DEVELOPMENT

In the Bureau's annual report for the fiscal year 1951 reference was made to the need for "a group of qualified personnel, free of responsibility for the everyday administration of Indian affairs, who could devote their full attention to the job of developing cooperatively with each of the major Indian groups an individualized program of resource development accompanied by constantly expanding Indian control over the management of their individual and tribal affairs." This need was met early in the fiscal year 1952 by the establishment and staffing of a Division of Program in the Bureau's Washington Office.

During the fiscal year the new Division devoted its attention largely to two main tasks. One was to develop the major outlines of policy and procedure that should govern programing activity throughout the

Bureau. The second was for individual members of the Division staff to work actively with Indian tribal groups and local agency staffs in stimulating and guiding the formulation of specific programs aimed at the ultimate objective of Bureau withdrawal from Indian affairs.

On the policy side primary emphasis was given to the principle of consultation with the Indians. In connection with contemplated transfers of functional responsibilities to State or local agencies, this means that the views of the Indians to be affected will be sought and carefully considered before any final action is taken. In the development of comprehensive programs affecting specific Indian groups, the Bureau not only seeks the views of the Indians involved but encourages their maximum participation in the actual job of data analysis and program formulation. In fact, this Bureau's ideal concept of its role in program development is that of a consultant to the Indian groups. As a practical matter, however, it is recognized that much of the initiative and responsibility for program formulation will have to be assumed—at least in the early stages—by Bureau representatives.

Another principle which received considerable emphasis during the year was that the development of a withdrawal program affecting any particular Indian group must be preceded by and based upon a compilation of all the relevant factual data. This includes such things as an inventory of tribal and individual Indian resources, a study of the laws and treaty obligations affecting the group, an appraisal of the status and effectiveness of existing tribal organization, and many others. The actual task of compiling factual data of this type with respect to several major Indian groups was one of the important jobs undertaken by the Division of Program during the fiscal year.

Another facet of Bureau policy on withdrawal was defined in February 1952 following a visit to the Washington Office of the Bureau by several leading members of the Osage Tribe of Oklahoma. In a letter to the chairman of the Osage Tribal Council the Commissioner of Indian Affairs enunciated three major points which were subsequently reproduced and brought to the attention of other tribes throughout the country. The three points are:

> 1. If any Indian tribe is convinced the Bureau of Indian Affairs is a handicap to its advancement, I am willing to recommend to the Secretary of the Interior that legislative authority be obtained from the Congress to terminate the Bureau's trusteeship responsibility with respect to that tribe.
>
> 2. If any Indian tribe desires modification of the existing trusteeship in order that some part or parts thereof be lifted (such as the control of tribal funds, the leasing of tribal land, as examples), and if the leaders of the tribe will sit down with Bureau officials to discuss the details of such a program of partial termination of

> trusteeship, we will be glad to assign staff members to work with the group with a view to developing appropriate legislative proposals.
>
> 3. If there are tribes desiring to assume themselves some of the responsibilities the Bureau now carries with respect to the furnishing of services, without termination of the trusteeship relationship, we are prepared to work with such tribes in the development of an appropriate agreement providing for the necessary safeguards to the tribe and its members.

This statement constitutes, in effect, a standing offer by the Bureau to work constructively with any tribe which wishes to assume either full control or a greater degree of control over its own affairs.

Actual programing activities of the Bureau during the fiscal year were focused primarily on five different types of Indian groups.

First were those groupings in which a substantial number of Indians had expressed a positive desire to achieve full independence from Federal trusteeship and supervision in the near future. In this category were the Indians of California (except for the Agua Caliente Band of Palm Springs), the 41 bands of western Oregon formerly under jurisdiction of the Grand Ronde-Siletz Agency, and the Klamath Tribe of south-central Oregon. Specific legislation designed to facilitate complete withdrawal was developed in consultation with the first two groups and presented to the Congress but not enacted. While no legislation was drafted affecting the Klamath Tribe, a number of consultations on the question of Bureau withdrawal were held during the year involving tribal leaders, representatives of the Oregon State government, and Bureau participants.

The second category included two tribes with substantial assets which are financing with tribal funds a major share of the cost of services and trusteeship provided for them by the Bureau—the Osage Tribe of Oklahoma and the Menominee Tribe of Wisconsin. Although both tribes indicated some initial reluctance to contemplate the prospect of Bureau withdrawal, a number of consultations were held with them during the fiscal year and efforts were being continued to elicit their active cooperation in the development of constructive programs.

The third category might be called the Missouri Basin group. This includes seven tribal groups which will be more or less directly affected by various flood-control and irrigation projects planned for the upper Missouri Valley and which are consequently faced with the necessity of planning some readjustment in their living patterns. The seven reservations involved are Fort Berthold in North Dakota, Standing Rock in North and South Dakota, and Cheyenne River, Crow Creek, Lower Brule, Rosebud, and Yankton in South Dakota. Programing studies of one kind or another were carried on at all of these reservations during the year. The most intensive work, however, was done at Standing Rock and Cheyenne River.

In the fourth category were several Indian groups, more or less remote from local agency headquarters of the Bureau, which are currently receiving from the Bureau only nominal services and supervision. Groups of this kind which were studied by the Bureau in an exploratory manner during the fiscal year included the Sac and Fox of Iowa, the several Indian bands and tribes of Michigan, and a number of tribes in Kansas and northeastern Oklahoma.

The fifth category included an assortment of tribal groups such as the Southern Ute and Mountain Ute of Colorado, the Jicarilla Apaches of New Mexico, the Red Lake Band of Chippewas in Minnesota, the tribes under jurisdiction of the Winnebago Agency in Nebraska, and the various bands under the western Washington Agency. Programing discussions were held with all of these groups during the fiscal year 1952 and additional sessions are planned for 1953.

INDIAN HEALTH

Although there was no marked reduction in mortality and morbidity rates among Indians during 1952, a number of basic developments will mark the year as the beginning of a new era of accomplishment in the health services.

Inauguration of a training course in sanitation for qualified young Indians and employment of graduates on their home reservations, expansion of the practical nurse training school for Indian girls, increasing cooperation with the United States Public Health Service with assignment of commissioned medical and dental officers to Bureau facilities, management improvement advances in hospital operations, increasing cooperation with State health departments in the field of public health and prevention of diseases, and definite action in line with the Bureau's withdrawal objectives all occurred during the year.

As part of the general emphasis on withdrawal objectives, the Bureau stated during the year that it will not continue to operate health facilities when other similar facilities are available to the eligible Indians without segregation. Final decision on the use of these alternative facilities is, however, to be made only after discussion with the tribes involved or with their governing councils. In line with this policy, the Fort Berthold Indian Hospital at Elbowoods, N. Dak., was closed August 18, 1951. Nine community or sectarian hospitals now provide hospital facilities and members of the State medical association provide medical services to the eligible Indians of this reservation. A small agency health staff is maintained at agency headquarters. This plan of providing services in established community facilities and through private practitioners of medicine was approved by the tribal council, the State health council, the State hospital, medical, and pharmaceutical associations, and the State commission on Indian affairs. At the close of the fiscal year the program was operating to the complete satisfaction of the Indians, the hospitals, the physicians, and the agency. Surveys made during the year pointed to the possibility of closing a minimum of seven additional Bureau hospitals in the near future.

The highest number of physicians and dentists since the mid-1930's were on duty during fiscal 1952. Even with an increase in physicians, at one time totaling 152, there has been no change in the estimated needs appearing in previous annual reports. A minimum of 250 physicians, including specialists, are needed—210 to staff the hospitals adequately and 40 to provide field services and preventive and public health activities. The past year saw the number of contracts for public health and preventive services with States (including the Territory of Alaska), counties, and local health units reach a total of 30. Under these contracts, $155,604 was paid by the Bureau.

Medical and Hospital Care

During the year, 62 hospitals and 10 out-patient dispensaries were in operation. Five of these were medical centers with specialized staffs, three were tuberculosis sanatoriums, and the remainder were general medical and surgical units. Their sizes vary from 18 to 420 beds. Of these hospitals 40 have fewer than 50 beds. In the continental United States 48 are located in isolated areas varying up to 85 miles from the nearest railroad, 12 are identified as 1-physician hospitals; but only 4 located in Alaska do not have part-time consultants immediately available.

At one time during the year, there were 152 physicians and 39 dentists on duty. Of these numbers, 85 physicians and 23 dentists were civil-service employees, 67 physicians and 16 dentists were commissioned officers of the United States Public Health Service assigned to the Bureau. The majority of these commissioned officers, having received their professional training at Government expense, have from 17 to 24 months of obligated service to perform. On June 1, 1952, there were on duty 74 civil-service medical officers of the Public Health Service as compared with 37 on June 30, 1951. There were 23 civil service and 16 commissioned dental officers.

During the year, there was a net loss of 13 civil-service medical officers. This loss was due chiefly to the lack of attractive salaries, to the isolated locations of assignment, to a lack of educational and training facilities within the service, and to a lack of other benefits.

Nursing Service

As is the case with doctors, the shortage of graduate, professional nurses continued to be felt at many of the Bureau's small hospitals, especially those in remote areas lacking educational, social, and recreational advantages.

Recognizing the need for additional well-trained, subsidiary personnel, especially practical nurses, the Bureau has proceeded with plans to open a school of practical nursing at the Mount Edgecumbe Medical Center, Sitka, Alaska. Although this school is in its initial stages of development and the first year's class will of necessity be small, it is anticipated that future graduates of the school, together with graduates of the Kiowa School of Practical Nursing, Lawton, Okla., will be valuable supplements to the nursing staff in hospitals in the States as well as in Alaska. Tentative accreditation by the National Association for Practical Nurse Education has been requested for the Mount Edgecumbe School during its first year of operation.

The status of the nursing staff, as of May 1, 1952, was as follows:

Total number of hospital nurse positions	846
Total number of hospital nurse vacancies	135
Total number of public health nurse positions	87
Total number of public health vacancies	29
Total number of practical nurse positions	175
Total number of practical nurse vacancies	35

Sanitation Activities

Environmental sanitation surveys of reservations and agencies in the Pacific Northwest were conducted in October and November 1951, by the Sanitary Engineer Consultant assigned to the Bureau by the Public Health Service in 1950. This completed a total of approximately 45 such surveys in 18 States and fulfillment of the primary purpose of the assignment. Recommendations were submitted concerning the type and scope of program designed to reduce the current high death and morbidity rates among the Indian population of those diseases usually attributed to faulty sanitation.

Studies were made of existing State and local public health facilities that might be of help in this respect. Unfortunately, in most instances those areas in greatest need of sanitation services are so located as to be without the advantage of full-time public health units under State or local auspices. Therefore, such services, at least for the present and near future, will have to be the responsibility of the Bureau.

During the fiscal year, an important step was taken toward assuming that responsibility. Through the area offices and in collaboration with the respective tribal councils, there were selected 12 Indian youths, 18 to 31 years of age, as sanitarian aides. Through the cooperation of the Public Health Service training staff these men were given an 8 weeks' orientation course at Phoenix, Ariz. Upon completion of the course, these sanitarians returned to their respective reservations where they are now engaged in demonstrating to their own people practical measures directed toward raising the level of sanitation at Indian homes and communities.

Tuberculosis Control

Tuberculosis case finding surveys continued through the year on the reservations. Such surveys were also made at every boarding school operated by the Bureau at the beginning of the school year and will be continued in the future. These surveys were made by mobile X-ray units of the Bureau and of the State health departments and the United States Public Health Service in cooperation with the Branch of Health.

BCG vaccination of the newborn was established as a routine with consent of the parents in the majority of Bureau hospitals. This program is based upon data that indicate that the unvaccinated child is seven times more likely to contract tuberculosis than is the vaccinated child. After the first 5 years' operation of this program, it will be unnecessary to continue vaccination of school students (begun in 1948) unless a student is found to have lost his immunity. An increasing number of tuberculosis patients were hospitalized under contracts in sanatoriums not operated by the Bureau. This program is scheduled to enlarge markedly during fiscal year 1953.

Oral Health Activities

The oral health program of the Bureau made its greatest advance to date during the fiscal year 1952.

The most outstanding progress was made in the field of preventive dentistry and public health. During the year a program of caries prevention was organized and instituted throughout the Bureau's jurisdictions. Topical application of sodium fluoride solution to the teeth of Indian children was made available to several thousand pupils in Indian schools by teams in five areas. At the Intermountain Indian School selected cases of malocclusion among the younger pupils were studied and treatment instituted as a preventive service.

The clinical care service program has gained steadily in level of quality care and in the quantity of such services. Conservation of teeth has become the rule rather than the exception, a policy that should have been insisted upon in past years.

Essential manpower is still below the need. As of June 1, 1952, all dental officer positions, which could be filled from available funds, were filled.

Approximately 40,000 children received preventive and corrective oral health services during this year 1952, an increase over the previous year. These services were made available to the school children at over 200 clinical sites.

INDIAN WELFARE

On June 30, 1952, the Indian Bureau's welfare program in California came to an end as county departments of public welfare throughout the State assumed full responsibility for providing any needed social services to Indian residents whether living on or off a reservation. Among the social services to be provided are child welfare services to Indian children in their own homes and to those in foster homes, as well as provision for general assistance to needy Indian families. California Indians will now receive needed social services on the same basis as other citizens of the State.

During the fiscal year 1952 emphasis was placed on better planning for the care of children made possible by the addition of a child welfare consultant to the central office staff. Studies are being made of family situations with efforts directed to working out any problems that keep children from their own family groups and from attending public schools.

During the winter reservations in the States of North and South Dakota experienced severe blizzard weather with heavy snows blocking roads and covering pastures and fields, with a consequent increase in requests for general assistance. However, the general case load throughout the Service decreased slightly, largely because of the transfer of cases to the program for aid to the totally and permanently disabled under the Social Security Administration.

The average number of persons given general assistance in 1952 was 6,059 a month compared to 6,392 in 1951. The monthly average of children placed in foster homes totals 387.

EDUCATION FOR INDIANS

During the fiscal year 1952 approximately 52,800 Indian children were enrolled in public schools. Of this number an estimated 21,800 have been fully accepted in the public schools with no aid from the Federal Government. Aid was supplied for the remainder—31,000 children—to local districts which were unable to assume the full cost because of nontaxable Indian lands in the districts through contracts negotiated under the provisions of the Johnson-O'Malley Act. The average cost to the Bureau amounted to approximately one-half of the total per pupil cost to the district.

In 1952, 14 State contracts and 27 district contracts were in effect. This is an increase of one State contract over the preceding fiscal year. A decrease of 15 district contracts from the preceding year was because of the consolidation of district contracts on a county basis in one area.

The Indian Bureau has withdrawn from direct school operations in the States of Idaho, Michigan, Washington, and Wisconsin. Bureau responsibility in these States (excluding Michigan) is exercised through financial assistance to the States under the provisions of the Johnson-O'Malley Act.

The Bureau operated during the year a total of 93 boarding schools, 233 day schools in 14 States and Alaska with an approximate enrollment in all schools of 38,000 Indian children. Of this number, 40 schools are high schools offering both vocational and college preparatory courses, and are accredited by the States in which they are located. Haskell Institute at Lawrence, Kans., is also accredited by the North Central Association of Colleges and Secondary Schools.

Since many of the pupils entering these schools could not speak English and were unfamiliar with many phases of modern living, emphasis was placed on the acquisition of English, and the development of habits, knowledge, and skills that would enable the students to make the adjustments necessary to their economic welfare.

Oklahoma provides education for all Indian children, except those who need boarding school care. A special services contract amounting to $320,000 was awarded to Oklahoma as compensation for the nontaxable land in the State.

Texas now holds a contract providing for the payment of $18,000 to the State for health, education, and welfare services for the Indian children on the Alabama-Coushatta Reservation near Livingston, Tex.

Contracts amounting to $14,862 were entered into with Brown and Jackson Counties, Kans. Seventeen school districts in which Indian children attend public schools were involved. District contracts will not be negotiated for fiscal year 1953 since the attorney general of Kansas has ruled that the State of Kansas cannot enter into such contracts.

The Kickapoo Day School, located near Horton, Kans., was closed effective the beginning of fiscal year 1952. During 1951 this school had an average daily attendance of nine pupils and three employees. The school district in which the school was located now provides education for the children. The budget for the operation of this school for the fiscal year 1951 was $9,921.

Arrangements were completed during the year for the cessation of Federal operation of the Heart Butte Day School on the Blackfeet Reservation in Montana. The local public school district will operate this school during the fiscal year 1953.

Discussions were also undertaken during the year with the Havre, Box Elder, and Big Sandy School Districts on the subject of placing federally operated day schools on the Rocky Boy's Reservation in the public school system.

In the Aberdeen area three Federal schools were closed and one Federal school converted to a public school. This action shifted approximately 160 children to public schools. In addition, 10 schools are operating under a cooperative financial arrangement between the Federal Government and school districts or counties. These schools enroll approximately 1,900 children. In other words, about 2,000 additional Indian children are now attending schools cooperatively supported and managed, or under complete public school administration.

In the Minneapolis area the only Bureau schools still operating were Pipestone Indian School, Pipestone, Minn.; Iowa Sac and Fox Day School; and Cherokee in North Carolina. A total of 1,370 Indian pupils was enrolled in Wisconsin and 2,626 in Minnesota, in public schools receiving Federal aid under Johnson-O'Malley contracts. Of these numbers, 1,021 and 2,118 respectively, were elementary pupils, or a total of 3,139. The average daily attendance for Pipestone, the only school of elementary level accepting boarding school enrollment from Minnesota and Wisconsin was 123.

The Portland area also made progress in transferring the responsibility for Indian education to the States. Each of the three States in the area—Washington, Oregon, and Idaho—is now operating under Johnson-O'Malley contracts, with a complete transfer of educational facilities to Washington and Idaho. In Oregon, the transfer is complete, except for the operation of a small reservation boarding school, a day school on the Warm Springs Reservation and a nonreservation boarding school at Chemawa.

During recent years there has been a steady increase in the number of children enrolled in Navajo Reservation schools. Figures for the 1951–52 school year show that this tendency is still in effect as there was an increase in enrollment of 750 during 1951–52 over 1950–51. Enrollment has increased from 5,916 in 1942–43 to 13,480 in 1951–52.

Through State contract money, some of the Navajo children are benefiting from public schools which are open to them. During the year four amalgamated schools (involving a pooling of public school and Indian Bureau resources) were opened on the Navajo Reservation at Chinle, Window Rock, Mexican Springs, and Navajo Pumping Station.

Attendance of Indian children in Arizona public schools increased to 3,521 (preliminary figure by Arizona State Board of Education) in the 1951–52 school year from 3,024 the previous year. The Bureau's contract with the Arizona State Board of Education for the fiscal year 1951–52, under the Johnson-O'Malley Act, was for $180,042, bringing the total amount paid to Arizona for education of its Indian youth to $942,600. Three-fourths of the salary of the State director of Indian education, who also serves Arizona as assistant State director of public instruction, was paid by the Bureau. Area officers are trying to get the State board of education to arrange for a full-time worker on Indian education matters.

With the closing of the Whiterocks Boarding School on the Uintah and Ouray Reservation, scheduled for fiscal 1953, the Bureau of Indian Affairs will be out of the school business in the State of Utah, except for the Intermountain School for Navajos at Brigham City. Integration of the Indian children within the public system has been accomplished in a manner satisfactory to all concerned. Some of the school buildings are being turned over to the State which will operate them as a part of the public school system.

Only three Bureau-operated schools remain in the State of Nevada: the Stewart Indian School, the McDermitt Day School, and the Goshute Day School.

In Alaska the Bureau is operating 92 days schools with 146 room-units as well as three boarding schools to provide educational opportunities for more than 5,000 native children who live in the isolated areas of the Territory. During the fiscal year 5 schools were successfully operated by the Territory under the Johnson-O'Malley contracts, and initial steps were taken to contract with the Territory for the operation of 8 additional schools during the 1952–53 school year. In addition, the transition of the Alaska Native Service school at King Cove to an independent school system under the Territorial department of education was completed. This school has an enrollment of 49 and has 2 units.

An analysis of all Alaska Native Service Schools was made to determine target dates for transfer to the Territorial school system. Plans call for completing the transfer to the Territory by 1960. Additional schools to be transferred each year are as follows:

School year	Number of schools	Enrollment	School year	Number of schools	Enrollment
1953–54	13	604	1957–58	14	549
1954–55	14	390	1958–59	15	478
1955–56	14	729	1959–60	11	459
1956–57	7	508			

INDIAN EMPLOYMENT

Placement of Indians in employment took place in fiscal 1952 at an encouragingly high level and on a much wider scale than ever before. Out of a total of approximately 59,000 Indian placements reported during the year, the Bureau's placement staff participated directly in about one-third. In contrast to the Bureau-assisted placements of 1951, which involved mainly Navajos and Hopis, those placed with Bureau assistance in 1952 were from a large number of tribal groups throughout the western United States and Alaska. Nearly 6,000 of the placements reported were in permanent employment and about two thirds of these involved Bureau participation.

In many areas the Bureau placement program made a significant contribution to defense activities through recruitment of Indians for steady employment in army depots and other military installations and construction projects located in isolated areas, where recruitment of labor is a major problem. This was especially true in Alaska where several hundred Indians and Eskimos were brought into their first contact with steady employment.

In order to assist Indians leaving reservation areas for permanent employment in becoming established in their new locations, the Bureau initiated a program of financial aid for such resettlers in January 1952. During the balance of the fiscal year assistance of this type was extended to approximately 1,000 Indians, including some 480 family units.

In the field of training to provide Indians with skills which they need for permanent employment, the most significant development of the year was the establishment of an apprenticeship program in the Navajo-Hopi area to teach 27 skilled trades. This activity, which was part of the 10-year rehabilitation program for Navajo and Hopis, was initiated in cooperation with a number of labor unions, the State Employment Services of Arizona and New Mexico, and the Labor Department's Bureau of Apprenticeship Training. It is being operated under the direction of a joint apprenticeship committee consisting of Bureau officials, Navajo and Hopi Tribal representatives, and officials of the Arizona and New Mexico State Federations of Labor.

Up to the fiscal year 1952, the placement program was in operation in only seven areas—Aberdeen, Billings, Juneau, Minneapolis, Muskogee, Portland, and Window Rock. Except for the Navajo-Hopi program in the Window Rock area, placement staff was assigned only at the area level and there was no provision for financial assistance. During the 1952 fiscal year, three additional area placement offices were established—at Albuquerque, Anadarko, and Phoenix; eight agency placement offices were established at the larger agencies—Pine Ridge, Rosebud, Turtle Mountain, Fort Berthold, Standing Rock (to cover Cheyenne River also), Consolidated Chippewa, Papago, Fort Belknap (to cover Fort Peck also), and additional staff was provided in Alaska and Oklahoma to cover nonreservation areas. Field placement offices, to develop permanent employment opportunities for Indians in the larger urban areas and to assist in problems of adjustment, were established at Los Angeles, Denver, and Salt Lake City replacing the former field offices in those cities which were concerned chiefly with seasonal placement of Navajos. In addition, one entirely new field placement office was opened during the year in Chicago.

The Bureau placement staff worked in close cooperation during the year with the United States Employment Service and its affiliated agencies, and with the Railroad Retirement Board, to make additional employment services available on Indian reservations. Specific working agreements were reached between the Bureau and the Arizona and New Mexico state employment service agencies whereby these State agencies would establish offices on the Navajo and Hopi Reservations in space provided by the Bureau.

ADMINISTRATION OF INDIAN LAND

In the administration of Indian land, during fiscal 1952, major consideration was given to the establishment of procedures to facilitate the orderly withdrawal of Federal services and supervision over the real property of the Indians, the development of the mineral resources, and the elimination of tenure problems which have resulted directly from the land allotment system when Congress enacted the general allotment act of February 1887 (24 Stat. 388).

The principal asset of Indians today is their remaining landholdings, which in many cases include valuable stands of timber and mineral deposits. Some of the land is extremely valuable for home sites and commercial enterprises. To effect an orderly withdrawal it is necessary to assist the Indians to marshal their resources, principally real property, to reduce scattered landholdings and undivided interests in lands to the least possible number and to prepare programs for the most advantageous use of these resources.

In fiscal 1952 the Bureau continued a study of the existing regulations pertaining to land transactions and assembled material for inclusion in new manuals covering the various phases of land work. This involved, among other things, the delegation of authority to the Area Directors to approve practically all transactions arising in connection with the major land activities. Significant progress was made in the preparation of manuals for guidance of the field officers in processing and the making of decisions on numerous types of land transactions.

Land Transactions

During the fiscal year, patents in fee were issued covering a total of 333 parcels of Indian land comprising a total area of 61,283.04 acres. Under supervised sale, 496 parcels of Indian-owned land comprising an area of 61,312.21 acres were sold for a total consideration of $1,713,537.84.

The demand for land by non-Indians and the high prices being paid have resulted in a steady increase in the number of Indians requesting sales of their land, the removal of restrictions or trust, and patents in fee, so that they may dispose of their holdings. In fiscal 1952 it became obvious that many Indians are progressing economically to the point where they are able to acquire additional tracts of land or to acquire all of the inherited interests in tracts in which they have inherited part interests. Other Indians are seeking to consolidate their holdings into workable units. As a result, the transfer of land continued at a rapid rate, but the number of calls for assistance was far in excess of those that could be handled by the available field staff, which was responsible not only for processing the land conveyances but also for appraisal of lands, oil and gas and mineral leasing, rights-of-way, and agricultural and business leases.

At the end of the fiscal year 1952, there were nearly 1,300 requests, in one form or another, from Indians for assistance in obtaining patents in fee that were not acted upon. The requests, that could not be handled by the present staff, for sale of Indian land totaled 4,940. Other requests not disposed of, for land conveyance, including exchanges between individuals, partitions among heirs, removal of restrictions against sale, and the like, totaled 1,550. There was also a backlog of work relating to purchases, leases for agricultural and business purposes, the preparation of data related to the determination of heirs to the lands in estates of deceased Indians, and the records of the titles to the land.

Interest in Indian Oil Grows

Interest in the oil and gas potentialities of Indian lands in the Dakotas and Montana reached a new high in fiscal 1952 following discoveries in the Williston Basin and the Murphy discovery well brought in on the Fort Peck Reservation. This is the first production on the reservation.

During the year, major operators paid substantial bonuses for oil and gas leases on Indian lands within the Fort Berthold, Standing

Rock, Cheyenne River, and Pine Ridge Reservations in the Dakotas and also on the Crow Reservation in Montana.

Development in the San Juan Basin of northwest New Mexico and southwestern Colorado resulted in heavy leasing activity on the Southern Ute, Ute Mountain, Jicarilla, and Navajo Reservations.

Discoveries on the Uintah Reservation, Utah, have stimulated leasing on the reservation. In all of these areas there is considerable wildcat drilling.

A contributing factor in the increased lease sales was the elimination during the year of the provision in the regulations that lessees may hold only a limited acreage. Approximately 600,000 acres were leased during the year for a bonus in excess of $7,000,000. Approximately 2,100,000 acres were held under lease at the end of the year. From 11,776 oil wells and 408 gas wells a royalty income of $6,853,825 was collected. The total income to the Indians from mineral bonuses, royalties, and rentals was in excess of $15,000,000.

The discovery of oil on the Fort Peck Reservation, Mont., resulted in requests that large areas be put up for lease. At the first lease sale ever held on the Fort Berthold Reservation, N. Dak., 17,290.16 acres sold for a bonus of $34 an acre. On the Cheyenne River Reservation, S. Dak., 20,320 acres were sold for a bonus of $60,000. Although no production was obtained on the Jicarilla Reservation in New Mexico, it continued to hold the strong interest of the operators. During the year the Jicarilla Apache realized almost $2,000,000 from bonuses. On the Uintah and Ouray Reservation, Utah, 22,500 acres brought a bonus of $1,700,000. On the Southern Ute and Ute Mountain Reservations, Colorado and New Mexico, 92,000 acres brought a bonus of $1,000,000.

While the reservations in the Dakotas and Montana ranked high in new leasing activities, the Indian lands in Oklahoma continued to hold the lead in production. A number of waterflood projects on the Osage Reservation have been approved. Development is not sufficiently advanced to predict the potentialities of the waterflooding. There was an increase in the number of leases sold and the bonus received in Oklahoma at both the Anadarko and Muskogee Area Offices. At the Anadarko office a record sale was held on March 12, at which 11,663 acres sold for a bonus of $231,904.84.

On the Quapaw Reservation, Okla., three lead and zinc mining leases, involving 305.22 acres, 18 subleases involving 930.48 acres, 6 tailing and remilling leases involving 876.60 acres, 3 chat and boulder leases, involving 279.92 acres were approved. Total income from mining operations for this jurisdiction was approximately $700,000.

Aside from the profits to the Navajos resulting from royalties and employment of Indian miners, the production of uranium on the

Navajo Reservation became a topic of national interest. During the year an ore-buying station was constructed and placed in operation at Shiprock, N. Mex. It is expected that actual construction of a uranium processing mill will start at Shiprock early in the ensuing year. Another ore-buying station was constructed in the Grants area of New Mexico, where there are a number of Navajo allotted uranium leases. Contracts were negotiated with the Universities of New Mexico and Arizona to conduct mineral surveys during the summer of 1952 on parts of the Navajo and Hopi Reservation with a view to locating the principal economic mineral products.

The impetus in Navajo uranium activities resulted in considerable measure from the careful study and initiative of the Navajo Tribal Advisory Committee. In 1952 the committee adopted a definite procedure for the issuance of mining permits to Navajos and others and encouraged the Navajos to participate both as mining operators and mining employees.

During the year, authority to approve uranium mining permits was delegated to the Navajo area office. The provisions of the prior delegations to the Osage Agency and to the area offices in Oklahoma were broadened with the result that in Oklahoma the administration of Indian mining leases in practically all phases is handled locally. Experience has demonstrated that the delegations to the Navajo area office and the Oklahoma Area Office has resulted in a reduction in the expense of handling the leases and brings quicker and more effective service to the Indians and the mining industry.

SOIL CONSERVATION

In the 11 years since the Indian soil-conservation program was initiated, much has been accomplished in protecting the Indian soil from erosion and in increasing its productivity. Even more has been accomplished in changing the mental attitudes of Indians and in motivating them to take progressive conservation action. However, only 10.2 percent of the total conservation program needed on Indian lands has been accomplished. The program needs to be accelerated materially in order to reduce the loss of Indian farm lands from the present level of 80 acres per day to a negligible figure and to use each acre properly in accordance with its capabilities.

With a Bureau contribution of $1,501,248 in appropriated funds, a soil-conservation program on Indian lands involving total expenditures of $11,806,831 was carried out in fiscal 1952 through contributions made by cooperating land operators. For every dollar of appropriated funds expended, the cooperators contributed $6.86 of the soil- and moisture-conservation program. On 16 reservations on which an analysis has been continuing for several years, it was found that for every dollar spent by the Bureau, farm production increased $32.51 and for every dollar the co-operator spent, it increased $3.38.

During the year material progress was made in soil surveys and land classification which are preliminary to actual initiation of soil- and moisture-conservation operations. This information has been utilized in cooperation with other personnel to establish realistic values of Indian lands and equitable lease rentals. This has brought more income to the owners when the land is leased or sold.

The summer of 1951 saw the continuation of the serious, prolonged drought in Arizona and New Mexico. To assist the Navajo and Hopi people in increasing their permanent water facilities, an erosion-control structure, called a deep-pit charco, was designed and introduced. During the year approximately 60 of these structures were installed in response to need, complete with permanent storage basin, collecting wings and dikes, desilting basins, and protected inlets. The value of these structures in controlling erosion, silt movement, and runoff was amply demonstrated.

During the year the basis was laid for a student trainee program. The primary purposes of the program are twofold: (1) to have additional technical personnel available during the good summer working period to render valuable field assistance in such subjects as soil surveys, land classification and engineering; (2) to provide technical personnel upon college graduation for immediate employment in the Bureau's conservation program. During the last month of the fiscal year, the program was operating for the summer of 1952 in seven of the areas.

Indians are increasingly taking a more active part in soil conservation. They have been instrumental in the forming of a number of soil conservation districts. In every case when the formation of a district is to be voted upon, the Indians have voted practically unanimously in favor of formation. In 1952, as a result of their efforts, 17 additional soil conservation district areas (including both new districts and enlargements of existing districts) were created to take in Indian lands. Indians are serving competently in increasing numbers on soil conservation district boards and Production Marketing Administration county committees. Many are also dealing now in direct relationships with such districts and committees rather than through the medium of Indian Bureau channels.

Over one-half of the Indian lands are not yet within soil conservation districts. In these cases, the Indians, with Bureau encouragement, are establishing soil conservation enterprises which are doing much the same type of work as the district organizations.

FOREST AND RANGE LAND

The Secretary and his duly authorized representative, the Commissioner of Indian Affairs, are required by law to practice effective sustained yield management on the Indian forest lands of tribes organized under the Indian Reorganization Act.

On non-IRA lands timber is sold under authority of 36 Stat. 857, sections 7 and 8. It is also the policy of the Secretary of the Interior to manage these lands in accordance with the principles of sustained yield management. Included under both categories are approximately 16 million acres with an estimated volume of 41 billion feet, board measure. According to present knowledge, 6 million acres of this area is commercial timber lands with an estimated volume of 30 billion feet, board measure.

The Bureau of Indian Affairs is also responsible for the protection of approximately 50 million acres of forest, grass, and brushlands and for sustained yield range management on approximately 48 million acres of such lands suitable for forage production for domestic animals. Most of the Bureau activities in connection with fish and wildlife consist in attempting to persuade the Indians to adopt better management methods and in gathering statistics and estimates relative to game and fish populations, the annual harvest, income and related matters.

The Secretary's policies with respect to timber management are applied wherever economically feasible to Indian forest lands. Some of the reservations are so small that cutting can be conducted only on a periodic basis. On all of the larger reservations the annual cut is adjusted to what is considered to be the annual growth increment or potential increment. In some instances, however, it has become necessary to cut in excess of increment because of the excess of overmature age classes of trees and heavy losses in such classes caused by insect or disease attacks. In every instance the ultimate goal is development of age classes distributed in such manner that a sustained annual yield of various forest products can be maintained.

It is believed that management of the range lands has been effective in promoting a high yield of domestic animals and at the same time conserving and protecting the grass and soil resources. On some of the larger reservations of the Southwest, however, living necessities of large Indian populations have resulted in the grazing of too many animals on the range. This, together with prolonged drought, has resulted in severe damage to the range and the soil. It is obvious that all of the Indians cannot continue to live on livestock operations and that the solution lies in developing livelihoods for them in other lines of endeavor off the reservations.

The operating table on page 46 gives major statistics covering Indian forest and range management over the past 3 years.

With particular reference to timber sales, it will be noted that both volume of timber cut and value of timber cut have increased considerably during the 3-year period 1949–51. This is due principally to increase in volume and stumpage value of timber cut under contract. This timber sold for an average stumpage price of $10.96 per thousand feet, board measure, during 1949. In 1950 the average per thousand price dropped to $10.25, largely because of the recession in the lumber industry of the previous year. In 1951 the average price increased to $12.58 per thousand. Included in the timber cut under contract totals for the year 1951 are 40,362 thousand feet, board measure, and value of $654,922 for timber cut by three large Indian sawmills.

Operating statement and comparison of forest and range management activities over the past 3 years

	Calendar years		
	1949	1950	1951
Timber sales:			
Total volume of timber cut—thousand feet, board measure (including timber cut under permit and free use)	573, 236	688, 791	719, 076
Total value of timber cut	$5, 411, 061	$6, 067, 847	$7, 720, 989
Volume of timber cut under contract—thousand feet, board measure	471, 630	563, 401	586, 633
Value of timber cut under contract	$5, 169, 462	$5, 755, 403	$7, 387, 827
Fire suppression:			
Total number of fires	1, 154	904	931
Area burned in acres	134, 460	33, 808	52, 076
Damage	$206, 495	$168, 282	$274, 523
Cost of suppression	$195, 300	$105, 710	$322, 882
Range management:			
Number of cattle grazed	562, 091	620, 404	650, 029
Number of horses grazed	103, 399	99, 922	94, 039
Number of sheep and goats grazed	881, 352	967, 193	884, 782
Cash income from grazing permits	$1, 368, 736	$1, 806, 605	$2, 238, 499
Value of free grazing	$2, 966, 783	$3, 450, 049	$3, 478, 478
Fish and Wildlife:			
Value of fish and wildlife harvest	$2, 554, 184	$2, 536, 998	$3, 097, 824
Total cash income collected	$6, 538, 198	$7, 562, 008	$9, 626, 326
Total value other income, including free use	5, 762, 566	6, 299, 491	6, 909, 464
Grand total value and receipts	12, 300, 764	13, 861, 499	16, 535, 790
	Fiscal years		
	1949	1950	1951
Obligations from gratuity funds for forest and range management and fire presuppression	$1, 009, 289	$1, 343, 629	$1, 525, 756

IRRIGATION

Progress in irrigation construction achieved during the year on the New Mexico portion of the Navajo Reservation resulted in extending existing irrigation systems and developing new and additional water storage. The improvements made are expected to provide sustenance for approximately 430 persons in 1,975 acres of additional land in calendar year 1952.

Feasibility studies of the proposed Shiprock project, the largest irrigation development contemplated for the betterment of economic conditions among the Navajos and Hopis, were made in terms of various ultimate project sizes and in conjunction with studies made by other agencies and groups. Irrigation water for this project will be diverted from a reservoir formed by the proposed Navajo Dam in the San Juan River. The ultimate needs of the Indians of this San Juan River water, to which they have time-honored prior rights, and the additional claims by other projects in the area, including a transmountain diversion to the Rio Grande Valley, have created an excessive demand upon the river's available supply.

Construction work completed on the Wapato irrigation project of the Yakima Indian Reservation in Washington included enlargement of the pumping plant and main canal to provide water for 2,000 additional acres under Satus No. 3 unit, and completion of a pumping plant to provide water for 10,000 acres of completely undeveloped lands under Satus No. 3 unit. These areas are approximately 90 percent Indian-owned and will produce crops estimated at $2,000,000 annually. Construction work accomplished during the fiscal year is as follows: One pumping plant having three 1,000-horsepower pumps; another having three 500-horsepower pumps; and a third plant of two smaller pumps for the maximum combined discharge of 75 cubic feet per second under a head of 30 feet. In addition, three power substations and 21.5 miles of 34.5 kilovolt transmission lines were completed for the pump installations. The Satus No. 2 main canal was also enlarged by a capacity of 300 cubic feet per second for 9 miles and two waste-way structures were constructed, also 3 miles of Satus No. 3 main canal were constructed with a capacity of 225 cubic feet per second.

In the land-development program on the Colorado River Reservation there are now over 32,000 acres under irrigation, approximately 23,000 acres of which have been subjugated in the period since 1946. For the colonization of Indians from less productive reservations, assignments of 40-acre tracts have been made to 242 Navajo and Hopi Indian families and 8,000 acres of newly developed lands are available for their use and assignment. Crops produced in 1951 on 25,500 acres of the project were valued at $3,312,000. During the fiscal year it was necessary to reduce the ground water table of the irrigated lands. This was accomplished by deepening, widening, and extending the existing drainage canals and drilling and equipping four drainage wells.

Because of increased precipitation in the Southwest, the prospects were that over half of the project lands of the San Carlos irrigation project could be farmed in 1952 as compared with about 25 percent in

1951. The ground water level under project lands is lowering at an alarming rate and a continuing program of drilling replacement wells of greater depth was necessary for irrigation purposes. During the fiscal year a new contract was negotiated with the Bureau of Reclamation for delivery of 14,000 kilowatts of electric power to the project's distribution system. New rate schedules for this power are now being formulated. Crops valued at $6,072,300 were produced on 37,330 acres of the San Carlos project during the calendar year 1951.

Four irrigation wells were completed on the Chui Chiu portion of the Papago Reservation in Arizona as part of the urgently needed program to develop approximately 12,000 acres of irrigable lands for the Papago Indians. Irrigated lands constitute the only natural resource available to these Indians. Irrigation development also continued in the subjugation of additional acreages on the Fort McDowell and Salt River Reservations in Arizona.

Lands farmed in New Mexico and in the Pueblos will also be increased and benefited because of the increased precipitation. Construction work on the Acoma, Jemez, Laguna, San Juan, Santa Clara, and Zuñi Pueblos and the Consolidated Ute and Mescalero Reservations consisted mainly of new canal construction, realinement of existing canals and the installation of masonry concrete and metal control structures. Substantial contributions of labor and materials were made by the Indians of the Taos, San Juan and Santa Clara Pueblos for the programs of irrigation construction, operation and maintenance and flood control.

On the Flathead irrigation project in Montana the rebuilding of approximately 15 miles of the rural electric distribution system was required to increase the power transmission capacities made necessary by the demands acquired during the past 5 years from old and new customers. Negotiations to establish adequate power rate schedules were undertaken between representatives of the project and the irrigation districts. Construction of canal and control structure improvements continued and included the replacement of approximately 50 structures. A complete drainage plan for the project was also considered by project representatives and officials of the irrigation districts.

On the drainage program of the Wind River Reservation, 7 miles of new drainage canals were constructed. In the Two Medicine Canal of the Blackfeet irrigation project, work was begun on the installation of buried membrane lining to prevent critical water losses and recurring breaks in the canal banks.

Flood waters from the Missouri and Milk Rivers in the spring of 1952 damaged irrigation canals, laterals and control structures on the Fort Peck and Fort Belknap Reservations. Estimates are that $35,000 will be requested for necessary repairs.

In California water supplies on miscellaneous small irrigation units were supplemented by additional pipe line construction and the drilling and equipping of wells. Negotiations for the development of approximately 10,000 acres of irrigable Indian lands in the Coachella Valley of southern California were initiated and carried forward.

INDIAN ROADS

In line with the general emphasis on withdrawal objectives, the Bureau has been undertaking an orderly transfer of the responsibilities for maintenance of roads serving Indian areas to county highway departments throughout the country. The approach which has been adopted involves first bringing the Indian roads up to county standards and then turning them over to the counties for future maintenance.

As far as road maintenance is concerned, counties clearly have an obligation to serve the Indians as they do other citizens since maintenance is financed from gasoline taxes and motor vehicle license fees which are paid by the Indians as they are by other citizens. Road construction, however, is financed to a large extent by revenues from land taxes which are not paid on restricted Indian lands. For this reason Federal appropriated funds are being used for the construction of additional reservation roads where needed (such as at the Navajo and Hopi Reservations) and for bringing existing Indian roads up to county standards.

During the fiscal year the Bureau turned over 64 miles of Indian roads to local agencies for maintenance. This included all of the Indian roads in Iowa and part of those in Wisconsin, Minnesota, Florida, Oklahoma, and other States. Altogether the Bureau has now transferred to the counties 1,038 miles of roads for which it formerly had maintenance responsibilities. In recent years the rate of transfer has been retarded by the shortage of construction funds needed to bring the roads up to county standards.

During the fiscal year, a survey was made of the Indian road needs in California as part of the general program of Bureau withdrawal from Indian affairs in that State. All Indian roads in the State were surveyed by a team of road engineers. The existing standards were compared with criteria developed by the Automotive Safety Foundation, and a program of bringing all of the Indian roads in the State up to a standard that will be acceptable to the counties was begun.

Road maintenance work was performed on 19,503 miles of road. Regular maintenance was performed on 8,500 miles and occasional maintenance on the remaining 11,003 miles. About the same amount of funds ($2,240,000) was available as in the 1951 fiscal year, but the actual work had to be curtailed somewhat to compensate for higher wage rates and increased costs of supplies and materials.

Only $1,358,000 was appropriated for road construction for 1952. The Navajo-Hopi road construction program, already lagging behind other phases of the 10-year rehabilitation programs, was allocated $858,000 which was used to grade and drain 44.7 miles and to surface 36.1 miles, 15.5 miles of which was blacktop and 20.6 miles of which was gravel surfacing. New bridges aggregating a span of 362 running feet were built.

The remaining $500,000 in road construction funds was used to correct small critical deficiencies on Indian roads throughout the country.

CREDIT

During the past year the program of assisting Indians to obtain financing for their economic improvement from non-Bureau sources was intensified. Some of the reasons why more Indians are not receiving financing from non-Indian Service lenders include the low economic status of Indians, lack of bankable security, lack of training in modern business practices, and the lack of knowledge and experience on the part of other agencies in dealing with Indians. In order to overcome some of these problems, action was taken to acquaint lending organizations in the areas where Indians reside with the policies and procedures in connection with making loans to Indians.

Special arrangements were made with the Farmers Home Administration and the Veterans' Administration so that the benefits of the lending programs of these agencies might be extended to Indians on the same basis as to other citizens. As trust or restricted land is the principal asset which a majority of the Indians have to offer as security for loans, the regulations were revised on September 22, 1951 (25 CFR 241.52), to permit the mortgaging of such lands. In order to facilitate the program, authority was delegated to the Area Directors of the Bureau to approve mortgages on individually owned trust or restricted Indian land given by the Indian owner to secure a loan from any bureau or agency operating under authority of Congress, a National or State bank, or any building and loan association operating under authority of the law of any State, if the loan is made to finance a productive enterprise operated by the borrower, is to provide housing facilities for him, or is for the purchase or construction of other improvements to be utilized by him. Such mortgages, however, are not permitted on forest land or land in a grazing unit, the loss of which by foreclosure would interfere with the management or use of the timber or grazing unit.

This revision of the regulations and delegation of authority should help to remove one of the obstacles formerly preventing Indians from securing credit from sources outside of the lending program being conducted by the Bureau and should also preserve the benefits of retaining land in a trust or restricted status.

Although a beginning has been made toward achieving the goal of having Indians receive all of their financing from the same sources that serve other citizens, most of the loans from such sources have been made to Indians in the higher economic groups. Until the Indians reach the point where they will have adequate bankable security, the lending program being administered by the Bureau in conjunction with Indian organizations will have to be continued to help the Indian people improve their economic status through financing productive enterprises.

As of June 30, 1952, $11,523,400 had been appropriated for the revolving fund for the purpose of making loans to Indians and Indian organizations. Repayments on loans and interest collected on loans are credited to the revolving fund and become available for further loans by the United States. Because of this revolving feature, loans totaling $21,584,993.25 had been made through June 30, 1952. Loans receivable as of that date were $11,335,261.33. Payments totaling $12,217,703.54 were due through June 30, 1952, of which $10,244,052.43 had been repaid; payments of $997,082.73 had been extended; $5,582.38 had been canceled; and $245,948.25 was delinquent. Payments totaling $725,037.75, for which credit had not been given at the close of the fiscal year, were in transit. Interest payments totaling $583,444.00 had been made as of June 30, 1951, and payments totaling $64,799.10 were in transit.

Of the repayments due through June 30, 1952, 89.78 percent had either been made or were in transit; 8.17 percent of due payments were extended; 0.04 percent had been canceled; and 2.01 percent was delinquent.

Tribes have supplemented funds borrowed from the United States with their own funds. They were using $8,537,444.58 of tribal funds in their credit operations on June 30, 1952. In a few instances tribal credit operations are conducted entirely with tribal funds.

Under the provisions of the act of May 24, 1950 (64 Stat. 190), which authorized cash settlements of "in kind" livestock indebtedness, cash had been accepted for 5,468 head of cattle and 894 sheep in the amount of $552,141.57 through June 30, 1952. Approximately 37,000 head of cattle were outstanding as of June 30, 1952. Efforts are being made to convert the revolving cattle pool to cash in order to eliminate a credit system peculiar to the Indians which does not provide for training in modern business practices.

The amount of funds used in relending by Indian corporations, tribes, and credit associations, and by the United States direct to individual Indians and cooperative associations during fiscal year 1952 was the largest for any year since credit operations were started in 1936. Loans are made to individuals by relending organizations to establish them in income-producing enterprises, as well as for educational purposes.

In addition to loans to individuals, enterprises are financed by corporations and tribes to provide new employment opportunities and training and job experience for their members. Enterprises such as salmon canneries, tourist and motel centers, logging and timber stores, and arts and crafts associations have been financed. As of June 30, 1952, a total of $40,911,059.68 had been loaned by relending organizations. About 37 percent of this amount has been used in the operation of enterprises, 3 percent has been loaned to cooperative associations, and about 60 percent to individual Indians. Of the amount due 92.82 percent had been repaid, 1.68 percent extended, 0.48 percent charged off, and 5.02 percent was delinquent or in process of liquidation.

It is estimated that 5,363 borrowers are now self-supporting as a result of their loans and other assistance given them.

INDIAN EXTENSION WORK

Through the encouragement and technical advice of Extension workers, Indians have been interested in the greater use of their lands and livestock. Since the inauguration of the Extension program in 1930, some 400,000 acres of cropland and 7,200,000 of range land have been taken out of a leased or nonuse status and put to use by Indians. Their range cattle numbers have increased from 170,700 in 1932 to 317,300 in 1951 and their dairy cattle from 11,300 to 39,400. The income from livestock enterprises increased from $1,229,000 in 1932 to $32,509,000 in 1951. While the increase in market prices has been an important factor in this gain, it is also attributable to the improvement made in farming methods, more scientific breeding of Indian livestock, the use of better seed, more and better cultivation, and better use of irrigation water.

Indian cattle now, because of their good breeding quality, and high market grade are not only welcome on all livestock markets, but are in demand and often top the market price. One of the most successful and largest artificial insemination projects with range cattle in the United States and probably in the world is being carried on by the San Carlos Apache Indians in Arizona. Some thousand purebred range cows are so bred each year and from their offspring the Indians obtain the bulls for their individual herds.

In the past 16 years the average agricultural income per Indian family on 25 selected Indian reservations has been increased from $313 to $1,526.

Home Extension Work

Among the major problems of Indian people today are nutrition, health, and housing. The 8 reservations having Indian Service home extension agents show 128 organized home extension groups and 62 special interest groups with an enrollment of more than 2,200 Indian women. The home extension agents have helped Indian families through these group organizations appreciate more fully the importance of proper diets, care and preparation of food and better home sanitation. The limited staff of 15 home economists reached over 8,000 different homes during the calendar year 1951. There were 3,032 homes which showed definite adoption of some improved practices as a result of home extension work.

During the past year assistance was given to 36 families in planning new homes and 130 families in remodeling old homes. Improved water and waste disposal systems, improved room arrangement, remodeling and refinishing furniture, selection of household furnishings and equipment, methods of pest control, selection and use of electrical equipment were a few of the home managements problems with which home extension agents assisted Indian families in 1951.

More than 1,700 Indian women were assisted during the year with clothing construction. Approximately 16,500 articles of clothing were made which were valued at over $41,000. Another important item was the 13,300 articles of household furnishings that were made during the year, having an estimated money value of more than $38,000. During 1951 the reports show over 2,200,000 quarts of food canned, 630,000 pounds of food dried, 3,800 pounds of food stored. With the high cost of food the production, preparation and storage of foods is important to Indian families.

Another phase of extension work is the 4–H Club program among Indian youth. It is set up on a nonsegregated basis in cooperation with the State extension services. During the fiscal year 549 4–H Clubs were organized on the various reservations with a total project enrollment of more than 11,000 Indian children and a completion record of 78 percent. The value of 4–H Club products was estimated at over $200,000 during the past year.

Contractual Agreements With States

Currently there are six contracts in effect with five States covering extension services to Indians. Prior to 1950 there were no State contracts, although the Indian women of the Fort Peck Reservation in Montana were being provided home extension assistance under a contract between the Fort Peck Indian Agency and Roosevelt County which had the approval of the Montana State Extension Service.

Since 1950 agreements have been entered into with the States of Washington, Nevada, and Oklahoma and an additional contract has been entered into with the State of Montana covering Glacier County. During 1951 the Menominee Tribe was assisted in entering into a contract with the State of Wisconsin for agricultural extension services on the Menominee Reservation.

INDIAN ARTS AND CRAFTS

The Indian Arts and Crafts Board continued its efforts to develop the arts and crafts already indigenous to each Indian area into articles marketable for present day use, high in quality of workmanship and design; to increase the prestige of the Indian artist and craftsman in his community, individually and in groups, by the public recognition of his work; to give training to talented young Indians in managing their own organizations so that they, in turn, can train other young Indian people in such efficient ways as will enable them to take their place in the competitive markets, ultimately without assistance.

In the southeastern part of the United States special attention was given during the year to the arts and crafts needs among the Seminoles of Florida and the Choctaws of Mississippi and to a strengthening of the program among the Cherokees of North Carolina. The North Carolina Cherokees have almost quadrupled the volume of their sales since 1948—from about $9,000 to approximately $34,000—and have increased the membership of their crafts organization from an original 10 to approximately 275. A tribally owned and operated crafts shop is maintained on the reservation.

In northern Great Plains region an arts and crafts specialist was assigned by the Board to assist the craft centers on the Turtle Mountain, Fort Totten, Rosebud, and Pine Ridge Reservations in the enlargement of their production and marketing programs.

A specialist was also appointed for the Alaskan area to teach, design, encourage, and be the liaison officer between the craftsmen and the market.

The Navajo Arts and Crafts Guild, now grown into the Navajo Tribal Industries, has greatly expanded its production and sales. Competent management, intensified training, a combination of part-time home work with shop centers, together with the interest shown by the tribal council, is resulting in a progressive program. The first year of operation under the new organization showed a small net gain.

The weaving program at Sequoyah, Okla., formerly a combination of school work and commercial production, in order to develop the association into a more effective production and marketing organization was separated from the school system during the year. The director of the association can now give his full attention to design, production, and sales.

At Billings, Mont., the Northern Plains Indians Crafts Association opened a retail shop, specializing in authentic intertribal Indian crafts, including noncompetitive products from other areas as well as those from the surrounding region. A successful venture is predicted.

In addition to the specific areas mentioned, the Board also extended assistance to other smaller groups and to many individual Indian craftsmen.

LEGISLATION AND LITIGATION

Drafts of the following important bills designed to implement the Bureau's withdrawal objectives were prepared or revised during the year by the Bureau's legal staff:

H. R. 3624: To confer jurisdiction on the State of California with respect to offenses committed on Indian reservations within such State.

H. R. 6695: To amend title 18, United States Code, entitled "Crimes and Criminal Procedure," with respect to State jurisdiction over offenses committed by or against Indians in the Indian country, and to confer on the State of Oregon civil jurisdiction over Indians in the State.

S. 1077: To confer jurisdiction on the State of Washington with respect to offenses committed on Indian reservations within such State.

H. R. 7489: To facilitate the termination of Federal supervision over the affairs of Indian tribes and bands and individual Indians that were under the jurisdiction of the former Grande Ronde and Siletz Agencies, Oregon.

H. R. 7490: To facilitate the termination of Federal supervision over Indian affairs in California.

House subcommittee hearings were conducted on all the above bills with the exception of S. 1077.

In addition to these bills, House subcommittee hearings were also held on H. R. 1551—Wisconsin civil and criminal jurisdictional bill and on rehabilitation bills for the Papago Tribe (H. R. 1214), for the Indians of western Oklahoma (H. R. 1635), and for the Sisseton-Wahpeton Sioux (H. R. 4132). The full House Committee on Interior and Insular Affairs conducted hearings on H. R. 1786 which is a rehabilitation bill for the Five Tribes Indians of eastern Oklahoma. During the year legislation was enacted and approved providing for per capita payments to the Utes (Public Law 120, 82d Cong.), the Shoshone and Arapaho Tribe (Public Law 133), and Menominee Indians of Wisconsin (Public Law 118).

The total number of reports on public bills prepared in the Bureau during the year was 56, and hearings on approximately 35 public bills were attended by Bureau representatives.

Significant Court Decisions

Of the Indian cases decided during the year special note should be taken of the cases summarized below for the rules of law which they establish.

"Identifiable Group" Under the Indian Claims Commission Act

In Ernest Risling et al. as the Representative and on the Relation of the Indians of California v. *United States*, the Court of Claims held that the Indians of California are an "identifiable group" under the jurisdictional provisions of section 2 of the Indian Claims Commission Act. In overruling the Indian Claims Commission, the court found that the history of the Indian Claims Commission Act showed the intention of Congress to permit groups of Indians other than tribes or bands to present claims under the act.

Heirship Determination

The Court of Appeals of the Ninth Circuit on May 13 held in the case entitled *Lee Arenas* v. *United States* (M–13012), that the United States as trustee for Eleuteria Brown Arenas was not bound by the lower court's decision in which it was determined Lee Arenas was his wife's sole heir. The court found that court which made the heirship finding did not have jurisdiction to ascertain heirs to trust property and that the act of June 25, 1910, is broad enough to cover the determination of heirship even though a trust allotment is issued after the death of the allottee and that the Secretary's determinations thereunder are final and conclusive.

Attorney Contracts

A proposed revision of attorney contract regulations (25 CFR 15) was prepared in July and printed in the Federal Register on August 11, 1951. In order to give all interested parties an opportunity to express their views, the Secretary conducted hearings on the proposed regulations January 3 and 4. Following these hearings, the Secretary decided that the proposed regulations should not go into effect and that further departmental study of the problem was required. Meanwhile, a Senate subcommittee began investigations of the subject in order to determine whether new legislation is required in this field. This investigation was still in progress at the close of the fiscal year.

MANAGEMENT

The coordination and direction of the work of approximately 13,000 employees in the Bureau of Indian Affairs is a management undertaking of major consequence (see table on page 70). Communication and correlation problems arise because of the widely dispersed field installations throughout the continental United States and Alaska.

Highlights of action during the past year to improve management included: (1) a survey of the Bureau's reporting system and the establishment of a mechanism designed to control reports, (2) solution of over-all problems involving organizational relationships, policies, and procedural standards through the further development, revision, and amplifications of the Indian Affairs Manual, (3) revision of parts of the Code of Federal Regulations to eliminate a great deal of procedural detail by including it in appropriate chapters of the manual, and (4) distribution of carefully prepared management notes to all supervisors to acquaint them with the latest techniques of modern management and to furnish background information on the Bureau's management-improvement program.

In line with the manpower-conservation program of the President, measures were adopted to insure the fullest participation by employees at all levels in the maximum utilization of their skills and abilities. Policy and objective statements regarding a sound and comprehensive Bureau promotion-from-within program were promulgated. Provision was made for each employee to receive detailed information and guidance concerning employee conduct and employee-supervisor relations. The incentive awards program was given added stimulus by the distribution of a chapter in the Indian Affairs Manual. The outline sets forth the essential steps necessary to qualify for an award. A short-term employment form was adopted. The procedure simplifies the appointing, changing, and separation by personnel actions in those positions not subject to the Classification Act of 1949.

Departmental and Bureau officials, in cooperation with representatives of the General Accounting Office, have developed an accounting system for the Bureau's many activities which follows, insofar as practicable, the accounting principles used in private business. The system is designed to serve management needs through a coordinated system of program, accounting, and budgetary reporting; to furnish accounting support for budget estimates; and to provide a basis for verification of the accountability of persons administering public and trust funds and property.

Bureau of Indian Affairs: Distribution of March employment, by area, appropriation, and activities

Appropriation and activities	Total	Aberdeen	Albuquerque	Anadarko	Billings	Juneau	Minneapolis	Muskogee	Phoenix and Sacramento	Portland	Window Rock	Washington, D. C.
HEALTH, EDUCATION, AND WELFARE SERVICES												
1. Hospitals, disease preventive and curative services	2,969	304	211	262	132	584	142	253	375	299	385	22
2. Educational assistance, facilities and services	4,469	712	424	374	88	432	109	241	591	121	1,363	14
3. Welfare and guidance services	90	17	4	4	2	6	4	13	12	3	18	7
4. Placement services	74	15	3	3	3	5	5	5	11	3	16	5
5. Maintaining law and order	79	18	1		6	2	4		18	9	19	2
Total	7,681	1,066	643	643	231	1,029	264	512	1,007	435	1,801	50
RESOURCES MANAGEMENT												
1. Forest and range lands	311	12	22		47		20		72	69	61	8
2. Fire suppression	100						100					
3. Agricultural and industrial assistance	243	30	12	13	25	10	5	19	41	21	38	29
4. Soil and moisture conservation	228	16	15	45	21		3	24	28	26	46	4
5. Operation, repair and mainteance of Indian irrigation systems	159	2	29		11				22	23	72	
6. Repair and maintenance of roads and trails	474	90	43	6	30		30	32	70	98	73	2
7. Development of Indian arts and crafts	4											4
8. Management of Indian trust property	238	37	8	27	15	5	18	42	29	19	20	18
9. Repair and maintenance of buildings and utilities	290	34	11	5	13	64	8	17	33	17	79	9
10. Weed control	15								13	2		
Total	2,062	221	140	96	162	79	184	134	308	275	389	74
CONSTRUCTION												
1. Buildings and utilities	387	2	10	34	12	54	1	4		1	246	23
2. Roads and trails	232	11	7	2	3		1	16	24	28	138	2
3. Irrigation systems	345	1	10		55				200	23	47	9
Total	964	14	27	36	70	54	2	20	224	52	431	34
General administrative expenses	642	85	38	24	68	43	17	32	87	65	59	124
Payment to Choctaw and Chickasaw Nations of Indians, Oklahoma	14							14				
Proceeds of power	129				74				55			

Trust funds:												
Indian tribal funds	338	6	3	85		20	65	1	44	114		
Indian moneys, proceeds of labor	346	70	70		25	27	10	4	48	14	78	
Operation and maintenance, etc., irrigation systems	454		1		98				99	256		
Transfer funds:												
Control of forest pests	1						1					
Missouri River Basin	70				67							3
Working funds, access roads	44										44	
Total	2,038	161	112	109	332	90	93	51	333	449	181	127
Grand total	12,745	1,462	922	884	795	1,252	543	717	1,872	1,211	2,802	[1] 285

[1] Includes 5 field employees paid on the Washington office payroll.

Aberdeen area includes the States of Nebraska, North Dakota, and South Dakota with 8 agencies, 10 hospitals, 10 boarding schools, and 55 day schools.

Albuquerque area includes the States of Colorado and New Mexico, with 4 agencies, 6 hospitals, 4 boarding schools and 28 day schools.

Anadarko area includes western Oklahoma and the State of Kansas, with 3 agencies, 4 hospitals, and 6 boarding schools.

Billings area includes the States of Montana and Wyoming, with 7 agencies, 5 hospitals, 2 boarding schools and 7 day schools.

Juneau area includes the entire Territory of Alaska, with 7 hospitals, 3 boarding schools and 96 day schools.

Minneapolis area includes the States of Iowa, Michigan, Minnesota, North Carolina, and Wisconsin with 4 agencies, 6 hospitals, 2 boarding schools and 5 day schools.

Muskogee area includes eastern Oklahoma and the States of Florida and Missisippi, with 3 agencies, 4 hospitals, 6 boarding schools and 10 day schools.

Phoenix area includes the States of Arizona, Nevada, and Utah with 6 agencies, 10 hospitals, 4 boarding schools and 25 day schools.

Portland area includes the States of Idaho, Oregon, and Washington with 8 agencies, 3 hospitals, 2 boarding schools and 1 day school.

Sacramento area includes the State of California, with 1 agency, 1 hospital, and 1 boarding school.

Window Rock area includes the Navajo and the Hopi Reservations in Arizona, New Mexico, and Utah and the Intermountain School in Utah, with 2 agencies, 6 hospitals, 14 area boarding schools, 37 community boarding schools, and 14 day schools.

A records survey was made at the Portland area office. This action brought about a better classification of records and improved utilization of filing equipment. Records having historical value were scheduled for General Services records centers. The greatest possible protection was given records retained at the field offices. This type of records-management work will be done at the other area offices.

A special team visited field offices and assisted with the installation of new property procedures. This team gave special attention to the disposition of scrap. Thousands of tons of critical material were channeled for sale. Wherever useful supplies were found in excess of current needs, these were listed for transfer to other activities or Federal agencies where a need existed.

The facilities of the General Services Administration were used extensively during the past year for the procurement of supplies and equipment for direct delivery to field installations. Purchasing has been centralized at the area offices. This has resulted in more advantageous use of supplies and equipment on hand and has done much to eliminate excessive stocks.

Arrangements were worked out during the year for the operation by the General Services Administration of the procurement and warehousing functions at Gallup, N. M. This has been extremely beneficial to the Window Rock area office and the Navajo Indians.

OFFICE OF THE SOLICITOR

Mastin G. White, Solicitor

GENERAL.—The Office of the Solicitor continued to perform, during the fiscal year which began on July 1, 1951, and ended on June 30, 1952, its functions of furnishing legal advice to the Secretary of the Interior and the other principal administrative officials of the Department, of supervising and coordinating the legal work and legislative program of the entire Department, and of acting for the Secretary of the Interior in the final disposition of certain types of administrative proceedings.

The office was unable, with the personnel available, to dispose promptly of all incoming matters, and some ground was lost during the year in the "battle of the backlog." Whereas a total of 359 items of work were on hand and awaiting attention in the Office of the Solicitor at the beginning of the fiscal year, this total had increased to 391 by the end of the fiscal year.

OPINIONS.—The Office of the Solicitor rendered 55 formal legal opinions during the fiscal year. Some of the legal questions dealt with in these opinions are indicated below:

M–36086.—Compliance by an employee of the Department with departmental instructions requiring that detailed reports be prepared concerning incidents resulting in property damage, personal injury, or death would be an action taken "in the proper discharge of his official duties" and, therefore, would be outside the scope of the prohibition contained in 18 U. S. C., sec. 283, with respect to Government personnel aiding or assisting in the prosecution or support of claims against the United States.

M–36085.—Where Congress, in a statute authorizing a particular activity, provides that the activity may be carried on by the administering official or agency "notwithstanding any other provisions of law," such official or agency is freed, insofar as that particular activity is concerned, from restrictive provisions of law contained elsewhere in statutes of general applicability, and is restricted only by whatever limitations Congress prescribes in the enabling act.

M–36095.—As the power of the Secretary of the Interior with respect to the granting of rights-of-way across Indian lands for oil or gas pipe lines is wholly discretionary, the Secretary may grant such rights-of-way subject to whatever conditions he deems to be appropriate.

M–36098.—Section 14 of the Veterans' Preference Act of 1944 is not applicable to officers or employees of territorial or insular governments established under the authority of the United States.

M–36106.—A released-time program under which public school pupils in Guam would be released during one period of the school day for religious instruction under the auspices of churches designated by their parents or guardians, but under which the religious instruction would be given at places provided by the churches and the public school authorities would assume no responsibility for the recruitment of pupils for religious instruction, would keep no attendance records with regard to such classes, would give no school credits for the completion of courses in religion, and would not approve or supervise the teachers of religion, could be conducted without violating the first amendment to the Constitution of the United States or the Organic Act of Guam.

M–36110.—An Indian band is a legal entity and may file a claim against the Government under the Federal Tort Claims Act because of damage allegedly done by a Government employee to an automobile owned by the band.

M–36117.—Alaska, an incorporated Territory, is not "outside the United States" for the purposes of section 2 of the Buy American Act.

M–36119.—The adoption by an Indian tribe of a constitution under section 16 of the Indian Reorganization Act does not relieve the tribe of the necessity of complying with section 2103 of the Revised Statutes in making contracts; but the Secretary of the Interior, in issuing a charter to an Indian tribe under section 17 of the Indian Reorganization Act, may grant the tribe freedom to make contracts without complying with the requirements prescribed in section 2103 of the Revised Statutes.

M–36121.—Under the act of June 25, 1910, as amended, providing for the determination of heirs and the approval of wills of deceased Indians who have left trust or restricted estates, the Secretary of the Interior has implied authority to allow all just claims against such estates.

M–35125.—So long as public lands are subject to the jurisdiction of the Secretary of the Interior, he may, on his own initiative, revise and correct erroneous actions previously taken within the Department respecting such lands.

M–36127.—The statutory authority of the Secretary of the Interior to determine the heirs of deceased Indians carries with it, by necessary implication, the authority to determine whether a particular Indian is deceased; and, in a proper case, the Secretary may rely upon a presumption of death and order the distribution of the restricted estate of the decedent.

M–36131.—The use by a State of its convicts in the performance of fire-suppression work on Federal lands within the State would not constitute the "employment" of convict labor by the State within the meaning of that term as used in Executive Order 325–A.

M–36135.—The Bank of American Samoa is a territorial, rather than a Federal, agency or instrumentality and, therefore (assuming it to be a corporation), is not subject to the provisions of the Government Corporations Control Act.

Appeals.—The office prepared a total of 286 decisions on formal appeals taken to the head of the Department by members of the public who were aggrieved by the actions of bureau officials. The appeals involved in these decisions are divided into the following categories: Appeals in proceedings relating to lands, 189; appeals relating to Indian probate proceedings, 39; contract appeals, 40; and appeals on claims involving property damage, personal injury, or death, 18.

Some of the points decided in disposing of formal appeals during the fiscal year are mentioned below:

Southern Pacific Railroad Company (A–26143).—Where public land has been withdrawn under the provisions of the Reclamation Act, a railroad company cannot obtain a right-of-way over the land under the act of March 3, 1875, so long as the withdrawal remains in effect; and the Secretary of the Interior, in connection with the modification of such a withdrawal in order to permit the acquisition of a railroad right-of-way across the land, may make his action contingent upon compliance by the railroad company with such conditions as the Secretary deems necessary or advisable in order to serve the public interest.

Annie L. Hill et al. v. *E. A. Culbertson* (A–26150–26157).—The authority of the Secretary of the Interior to cancel an existing oil and gas lease on a tract of public land extends only to situations where the lessee has failed to comply with the requirements of the lease, or the lease was obtained in contravention of some statutory provision or departmental regulation or under circumstances providing grounds whereby a contractual relationship between private parties could be canceled.

Wayne N. Mason et ano. (A-26176).—Where an isolated tract of public land containing two or more subdivisions is to be disposed of at a public sale, and two or more owners of contiguous lands assert their preference rights to purchase the tract, it is the ordinary rule that the subdivisions are to be equally apportioned, as far as possible, among the competing preference-right claimants.

James Des Autels (A-26245).—Where the amount tendered as filing fee and rental in connection with an application for a noncompetitive oil and gas lease on an area of public land is insufficient for the acreage sought, and the application is subsequently modified to eliminate the excess acreage, the modified application is effective only as of the date of the modification; and it is subordinate to proper applications filed by other persons during the interim.

Seaboard Oil Company of Delaware (A-26246).—A lessee that filed a statement pursuant to section 15 of the act of August 8, 1946, electing to have its oil and gas lease governed by the applicable provisions of the 1946 act rather than by the provisions of law in effect theretofore, cannot subsequently revoke such election.

United States Oil and Development Corporation (A-26269).—Assuming that under section 39 of the Mineral Leasing Act the Secretary of the Interior may assent to a suspension of operations and production under an oil and gas lease for a period of time antedating the giving of the assent, and thus extend the life of the lease for an equivalent period, such relief, being a matter of grace, should be granted only to lessees who use reasonable diligence to obtain it.

The Ohio Oil Company (A-26292).—Where a portion of an area of land acquired by the Department of the Army for an ordnance depot is fenced outside the depot proper and is temporarily leased to a private person for agricultural uses, such leased portion nevertheless constitutes land "set apart for military purposes" and is not subject to leasing under the Mineral Leasing Act for Acquired Lands.

Bettie H. Reid et ano. (A-26330).—If the Department determines that a tract of public land which is not within any known geological structure of a producing oil or gas field will be made available for oil and gas development, the Department is under a mandatory duty, imposed by statute, to lease the land to the qualified person first applying for it; and where a noncompetitive oil and gas lease was erroneously issued to a junior applicant, the lease is subject to cancellation.

C. A. Rose (A-26354).—Where an obviously erroneous bureau decision failed to recognize the preferential right of the first qualified applicant to obtain a noncompetitive oil and gas lease on a tract of land being leased by the Department, and the applicant, although his right of appeal was expressly called to his attention, failed to take an appeal within the period allowed by the departmental regulations for that purpose, the preferential right must be regarded as having been abandoned.

Mary M. Morley (A–26373).—A married woman, in the absence of proof of desertion by her husband or other circumstances making her in reality the head of the family, is not eligible to make a homestead entry.

Durham and Sauer (CA–124).—Where a contracting officer is charged with full responsibility for the execution of a contract, subject only to review, on appeal, by the head of the Department or his duly authorized representative, the contracting officer's decisions cannot be altered or countermanded by supervisory bureau officials who are not parties to the contract.

The Standard Transformer Company (CA–129).—Where a contractor breached a supply contract by failing to make delivery within the time specified in the contract, and the Government permitted the contractor to complete the performance of the contract, the contractor, in the absence of a pertinent provision in the contract covering the subject of damages for such delay in delivery, is only liable for such consequences of the breach as may reasonably be supposed to have been within the contemplation of the parties at the time when the contract was made.

Estate of Joseph Carter (IA–17).—The personal and domestic relations of the members of Indian tribes are regulated according to their tribal customs and laws, except as Congress expressly directs otherwise; and when the Secretary of the Interior, in the process of determining who shall inherit a restricted Indian estate, makes findings regarding the marital status of the deceased Indian and the legitimacy of his children, the Secretary is not bound by the provisions of State or territorial laws on the subject.

Estate of Lyon Saupitty (IA–52).—The law of the State of Oklahoma on the revocation of wills has no applicability to the will of a Comanche Indian domiciled in that State, devising trust property situated in Oklahoma.

Estate of Kneale Blackbird (IA–62).—An examiner of inheritance can consider and allow a claim against the restricted estate of a deceased Indian only upon notice to the interested parties and affording them an opportunity for a hearing.

TORT AND IRRIGATION CLAIMS.—The Office of the Solicitor disposed of 84 claims based upon property damage, personal injury, or death.[1]

LEGISLATION.—The following statutes of major importance to the Department of the Interior were enacted by the Eighty-second Congress during the fiscal year 1952:

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[1] In addition, the office disposed of 18 formal appeals taken by members of the public from decisions rendered by field attorneys upon such claims.

The Defense Production Act of 1950 was twice amended and extended during the fiscal year, first by Public Law 96, approved July 31, 1951, and again by Public Law 429, approved June 30, 1952. Titles I, II, III, and VII of the Defense Production Act are the foundation for many of the functions performed by the Department of the Interior in aid of the national defense program. Under the terms of Public Law 429, these titles will continue in effect until June 30, 1953. That statute, as well as Public Law 96, made numerous changes in the text of the Defense Production Act. In general, the changes bearing upon the work performed by this Department, unlike the more radical alterations made in some of the other features of the act, were clarifying and perfecting in nature. However, participation by the United States in the International Materials Conference was limited by Public Law 429.

In order to protect the scenic qualities of the approach highway to Grand Canyon National Park, mining locations within the adjoining lands in Federal ownership were subjected to restrictions by Public Law 77, approved July 12, 1951.

A necessary step in the development of Independence National Historical Park in Philadelphia was accomplished through the enactment of Public Law 212, approved October 26, 1951. In order to provide a proper setting for Independence Hall and its adjacent historic sites, many of the surrounding commercial properties are in the process of acquisition by the National Park Service. The new act provides for the administration of the acquired properties pending their ultimate demolition, and for the use of the revenues derived from them in furtherance of the park project.

Disposition of the large sum of money awarded the Ute Indians on account of a taking of their lands by the United States was provided for in Public Law 120, approved August 21, 1951. This act authorizes the use of the money in accordance with a long-range program for the development of a self-supporting Ute economy. A significant feature of this program is that it was worked out by the Indians themselves, rather than by Federal officials.

Better use of Indian hospital facilities and better medical services to Indians are contemplated by Public Law 291, approved April 3, 1952. This legislation authorizes the acceptance of non-Indian patients in Indian hospitals, the transfer of Indian hospitals to State or local administration where appropriate, and the obtaining of medical services for Indians through contracts with local physicians. At the same time, the Indians are assured priority in the use of health facilities provided for their benefit. Through the cooperative procedures authorized by this legislation, a more adequate degree of medical care can be provided for both Indians and non-Indians in many sparsely settled regions of the country.

The current need for strengthening the enforcement of the laws and regulations protecting migratory birds was recognized by Public Law 182, approved October 20, 1951. Under this act, the portion of the receipts from the sale of Migratory Bird Hunting Stamps that may be used for administrative and enforcement purposes is increased from 10 percent to 15 percent.

The excess-land provisions of the Federal reclamation laws were relaxed for the San Luis Valley project in Colorado by Public Law 415, approved June 27, 1952. The general prohibition upon the delivery of water to lands in single ownership within a Federal reclamation project that exceed 160 acres in area was made inapplicable to the San Luis Valley project, and a new special prohibition was established to the effect that no landowner on this project shall receive a water supply greater than that reasonably necessary to irrigate 480 acres of land served by the project. The act expressly states that it is intended to meet special conditions existing on the San Luis Valley project, and that it is not to be considered as altering the general policy of the United States with respect to the excess-land provisions of the reclamation laws.

Two noteworthy actions were taken during the fiscal year in the way of resolving interstate disputes over rights to the use of water through the interstate compact procedure sanctioned by the Constitution. The Yellowstone River Compact entered into by Montana, North Dakota, and Wyoming was consented to by the Congress in Public Law 231, approved October 30, 1951. The Canadian River Compact entered into by Oklahoma, Texas, and New Mexico was consented to by the Congress in Public Law 345, approved May 17, 1952. The first of these compacts will facilitate the undertaking of irrigation and power improvements that form important parts of the Missouri River Basin plan previously approved by the Congress. The taking effect of the second was a legal prerequisite for the initiation of the municipal water supply project in northwest Texas authorized by the Congress in 1950.

The Federal-Aid Highway Act of 1952 came into being through the enactment of Public Law 413, approved June 25, 1952. This act authorizes the appropriation of specified sums for national park roads, national parkways, Indian reservation roads, and defense access roads. In addition, the work of the Department of the Interior will be facilitated in some particulars by the other appropriation authorizations contained in this measure.

Submerged Lands of the Continental Shelf.—The fiscal year 1952 ended without any specific guidance having been provided by the

Congress for the executive branch with respect to the administration of the oil and gas deposits contained in the Continental Shelf of the United States. In the absence of such specific guidance, the executive branch has not deemed it feasible, during the several years that have elapsed since the rights of the Federal Government in the Continental Shelf were upheld by the Supreme Court in the cases of *United States* v. *California* (332 U. S. 19 (1947)), *United States* v. *Louisiana* (339 U. S. 699 (1950)), and *United States* v. *Texas* (339 U. S. 707 (1950)), to do anything more than (1) stipulate with California regarding the continuation of oil and gas operations in the submerged areas along the California coast during the pendency of the ancillary proceedings before the Supreme Court to determine the extent to which these oil-producing submerged lands are Federal lands of the Continental Shelf and the extent to which they are State-owned lands underlying navigable inland waters; and (2) grant permission, as a conservation measure, for the continuation of the oil and gas operations which were in progress off the coasts of Louisiana and Texas at the time when the Supreme Court entered its decrees in the cases against these States, plus the issuance of permits for additional drilling where this has appeared to be necessary in order to achieve conservation objectives.

During the second session of the Eighty-second Congress, the Congress passed Senate Joint Resolution 20, the primary purpose of which was to convey to the coastal States the submerged lands of the Continental Shelf situated inside the respective States' seaward boundaries as of the time when they entered the Union. Senate Joint Resolution 20 was vetoed by the President for the reason, among others, that "it would turn over to certain States, as a free gift, very valuable lands and mineral resources of the United States as a whole—that is, of all the people of the country." Thereafter, the second session of the Eighty-second Congress came to an end without any action having been taken by the Congress on the matter of overriding or sustaining the President's veto. Thus, the proposed measure failed of enactment.

OFFICE OF TERRITORIES

James P. Davis, Director

INTRODUCTION

All policies and programs of the Office of Territories have the same central theme—to arouse, encourage, and assist the people of the Territories in attaining the highest possible level of political, economic, and social advancement. Within this concept are included all of the activities and programs of administration, representation, and management which make up the work of the Office.

This report will show significant progress of many kinds and in each of the functional areas covered. Thus, in the political field the completion and approval of the Constitution of Puerto Rico, the rising support of statehood for Alaska and Hawaii, the completion of a proposed new organic act for the Virgin Islands, the successful operation of the first civilian administrations of American Samoa and the Trust Territory of the Pacific Islands, and the fine record of the legislature and people of Guam under their own government are all significant.

In the economic and management fields likewise there are worthwhile developments to report. In Alaska substantial highway and public works construction and the final phase of The Alaska Railroad rehabilitation program have been carried out. In the Virgin Islands important public works projects for harbor improvement, hospital and school facilities and a new telephone system are under way. The Virgin Islands Corporation has taken over and is modernizing the St. Croix electric power system and will soon do likewise for St. Thomas. In Guam, private enterprise is expanding rapidly and, with advances being made in public services, the Territory is acquiring the stability and character of a modern American community. In American Samoa and the Trust Territory the foundations have been laid for sound government administration and steps taken to chart the course for economic and commercial development.

The Office has continued during the past year to report territorial progress and problems to the President and the Congress, and it is most gratifying to record the sympathetic attitude of both the executive and legislative branches of the Government toward Territorial problems—with the exception only of the congressional refusal of statehood. Federal agencies have been encouraged and assisted in carrying out their responsibilities in the Territories. The Office has participated in dealing with problems of foreign policy of concern to the Territories and is the operating agency for training aspects of the Point 4 program in the Caribbean. It is also responsible for the operation of The Alaska Railroad and the Alaska Road Commission, the Puerto Rico Reconstruction Administration, the Virgin Islands Corporation, and the public works program of Alaska and the Virgin Islands.

Alaska, Hawaii, and Guam have shared in the general prosperity common to all the States. To a lesser extent, this general prosperity has affected others of the Pacific islands. In American Samoa and in the Trust Territory, both civil governments and island populations and their governments are faced with problems brought about by a varying transition from subsistence to money economies. Such difficulties as have been encountered have been accentuated by appropriation limitations which have restricted government budgets. The Office of Territories will continue to work for the economic advance of these areas in the knowledge that political development is often conditioned by the rate of progress toward economic health.

ALASKA

Legislation

The statehood bills introduced early in the Eighty-second Congress were perhaps the most important legislation pending during the fiscal year affecting Alaska. After a hard legislative battle in which great gains in support of statehood were clearly shown, the bill was recommitted by one vote. It may be expected to come up again next year.

Quantity restrictions on the unloading of explosives in Alaska ports posed a serious problem for the important construction and mining industries in the interior. This situation was relieved by legislation passed in the second session of the Eighty-second Congress (Public Law 562, approved July 16, 1952) which authorizes the unloading of properly packaged explosives in Alaska in accordance with local ordinances or other comparable regulations.

Coal Production

In a major effort to expand coal production in Alaska, the Office of Territories worked with other Interior agencies and the military authorities in evolving a new coal program. Basically, this program consists of (1) assisting the expansion, where appropriate, of existing producers; (2) opening to lease those coal reservations no longer required for Government purposes; (3) reactivating the coal-testing laboratory at Anchorage; (4) the acquisition of additional hopper cars by The Alaska Railroad; (5) the construction of any necessary rail spurs or access roads; and (6) a program of awarding military contracts well in advance of the summer mining season. It is expected that the above steps will assure adequate coal supplies for both civilian and military needs.

Alaska Public Works Program

The Alaska public works program authorized by Public Law 264, Eighty-first Congress, now in its second full year under Office of Territory management, continues to provide, within the limitations of available appropriations, public works including sewer and water facilities. Completed installations are to be purchased by these communities at prices averaging 50 percent of cost. Work has been completed on 12 of the 18 projects totaling $4,900,000 which were allotted prior to June 30, 1950, with the other 6 to be completed within a few months. Construction has been started on 10 of the 12 projects of the 1951 program totaling about $4,100,000 and they are 40 percent completed. Of the 14 projects of the 1952 program amounting to nearly $6,500,000, construction is under way on 10 projects. In the 1951 appropriation act, the Congress required that any project financed be certified as of value to defense. Applications on file at the time this legislation was enacted were so certified by the Department of Defense.

The Eighty-second Congress recently provided $12,554,200 for 15 projects of the 1953 program. The communities affected had previously arranged, by election, to assume their share of the project costs. Allotments have been made and construction plans are in advanced stages of development.

Maritime Problems

A west coast shipping strike, called in the last week of May 1952, prevented the sailing of ships, other than emergency, of one of the two principal domestic steamship lines serving Alaska. Unsettled at the close of the fiscal year, the strike resulted in some delay in carrying forward certain important construction and mining activities which normally reach their peak toward the latter part of June, and added to unemployment problems caused by an unusually large inflow of workers from the States. The strike emphasized the continued dependence of Alaska upon maritime service.

Progress in Rail Transport

The Alaska Railroad had over $18,000,000 of revenue in the fiscal year 1952 for the biggest income year in its history. While this is primarily freight revenue, the improvements brought about by the rehabilitation program are most strikingly illustrated by the streamlined passenger train, the Aurora, which is providing daily service from Anchorage to Fairbanks during the summer on an accurately maintained 12-hour schedule. Less dramatic but of greater importance to military and civilian needs for transportation has been the speed-up of freight service through improved roadbed, track, and equipment, and the 80- and 90-car trains, powered by three or four Diesels in tandem, that move out of Anchorage daily.

The rehabilitation program, now almost complete in terms of original plans, has enabled the railroad to provide transportation at a cost to shippers—except for terminal charges—equal to or less than the rail charges of the late 1930's. Rail costs have thus been a constantly decreasing portion of the cost of goods used and sold in Alaska. Increases in labor and material costs during the year, however, overbalanced the increases and a small operating deficit was incurred. A new rate structure, approved to become effective early in the fiscal year 1953, involved in part an equalization of rates between the military port of Whittier and the commercial port of Seward. The cost to civilian shippers will be little changed except in the case of a few commodities which had inequitable rates in the old tariff.

The insistence of the Military Establishment on exclusive rights to use the port of Whittier made it necessary to alter previous intentions to abandon the Seward-Portage line and use Whittier for both civilian and military traffic. Furthermore, military authorities now consider two rail ports essential to defense. This inevitably means the rehabilitation of this portion of the rail line, but funds for this purpose have not yet been appropriated.

Improvement in Highway Transport

Perhaps the most important basic development program in Alaska is the highway program of the Alaska Road Commission. Since

1949 road mileage has increased from 2,926 to 3,141. During the year the Anchorage-Seward Highway was opened to traffic, thus affording for the first time, a road link between two of Alaska's most important cities. In addition, more than one-third of the road mileage classed as "through roads" has been hard-surfaced. The main emphasis in the fiscal year 1952 was placed upon further improvement of an integrated road system, surfacing the principal routes and replacing inadequate bridges, and elimination of hazardous sections of road so as better to serve both defense requirements and the highway transport demands of the civilian economy.

During the year the Office of Territories, after a 2-month field investigation, completed a major survey of wage and salary and labor relations problems for the Alaska Road Commission. In accordance with the facts disclosed by this survey, the Commission is making important changes in its personnel policies. As a result of the changes already made, savings in payroll have been achieved which, on an annual basis, will amount to several hundred thousand dollars.

Air Transport Developments

In March 1952 the Civil Aeronautics Board announced new procedures to go into effect in the following month which would facilitate the issuance of permits for common-carrier operations across the Alaska-Canada border. The Civil Aeronautics Board and the Canadian Air Transport Board propose to hold concurrent proceedings on applications requiring authorization from both Boards.

Public Law 160, approved October 10, 1951, permits the Secretary of Commerce to lease for 20 years real estate belonging to public airports in Alaska for the purpose of erecting buildings necessary to their operation. Previous leasing periods permitted by statute were insufficient to encourage private operators to erect hangars and other facilities. During the fiscal year 1952 airports at Eagle, Haines, Kougarok-Quartz Creek, Seward, Sitka, Valdez, and Circle Hot Springs were approved for construction or improvement under section 16 of the Federal Airport Act of 1946.

Alaska Science Conference

The success of the first Alaska Science Conference, held in Washington, D. C., in November 1950, prompted a resolution to hold a second conference at Mount McKinley National Park under the joint sponsorship of the University of Alaska and the newly organized Alaska Division of the American Association for the Advancement of Science. The objectives of the conference, held September 4–8, 1951, were to review individual investigations in order that Canadian and American scientists might better coordinate and develop their research projects in Alaska and adjacent areas of Canada. It is planned to hold the third annual science conference at Mount McKinley National Park in September 1952.

THE COMMONWEALTH OF PUERTO RICO

Achievement of Internal Self-Government

The new Constitution of the Commonwealth of Puerto Rico, authorized by Public Law 600, Eighty-first Congress, was drafted by the constitutional convention, ratified by the Puerto Rican people, and accepted by the Congress to become effective on July 25, 1952, under proclamation of the Governor.

The constitution replaces those provisions of the 1917 Organic Act which established the structure of the Government of Puerto Rico and prescribed the handling of its internal affairs. Other parts of the Organic Act remain in effect as the Puerto Rican Federal Relations Act.

In establishing a framework of government for the Commonwealth, the constitution sets forth a bill of rights somewhat more extensive than that of the Federal Constitution, provides for a three-branch government, and includes various general, transitory, and administrative provisions, including a mechanism for amendment. Legislative responsibility rests in the legislative assembly normally composed of 27 senators and 51 representatives directly elected every 4 years. This membership may be increased by additional members from minority parties if the majority party receives more than two-thirds of the membership of either house. The executive responsibility rests in a Governor, directly elected every 4 years, assisted by a secretary in the direction of each of eight departments: State, interior, education, health, treasury, labor, agriculture and commerce, and public works. The judiciary responsibility rests in the supreme court which, in addition to constituting the court of last resort in Puerto Rico, is also responsible for administration of the judicial system of the island. Secretaries of departments and justices are appointed by the Governor with senate confirmation.

Puerto Rico's Contribution to the World Responsibilities of the United States

As in the previous year, Puerto Rico made an important direct contribution to the various programs of mutual security through technical assistance. Administered by the Office of Territories through the Point 4 office of the Puerto Rico Planning Board, the program involves supervised training for foreign nationals both under auspices of the United States technical assistance program (Public Law 165, 82d Cong.) and under those of the United Nations. The Government of Puerto Rico appropriated $25,000 for technical assistance in 1952 and, in addition, absorbed all costs in the various agencies without benefit of those reimbursements customarily required by Federal agencies. Under these United Nations and United States programs a total of 273 trainees has visited Puerto Rico to receive training during fiscal year 1952. As of June 30, 1952, 141 of these were in the island. Specific countries represented included 19 Latin-American countries, other Caribbean areas, Ceylon, India, Nepal, Pakistan, Israel, Gold Coast, Egypt, Liberia, Formosa, Thailand, Philippines, and Malaya.

Under the United States programs alone, the previous year's emphasis on the Latin-American region continued to be significant. It included 14 training grants awarded by the Office of Territories to Latin Americans at the approximate total cost of $28,900, and an extensive vocational program for trainees from the Caribbean area at a total cost of $93,000. Thus, the total in grants under the United States program was approximately $122,000, while administrative funds available for the year totaled $45,820.

During the coming year it is expected that Puerto Rico will continue to play an increasing role in the various technical assistance programs. Its significance as a partly developed area, its bilingual competence, its experience with agriculture and commerce under tropical conditions, and, above all, the enthusiastic interest of its Governor, its Planning Board, and other governmental bodies, give it a unique usefulness as a laboratory for underdeveloped areas all over the world.

Puerto Rico also continued to contribute heavily to military aspects of the world responsibility of the United States. As the fiscal year closed, most of the Sixty-fifth Infantry Regiment was about to be returned to Puerto Rico from Korea, where it has fought with distinction and valor with the United Nations forces and has incurred some 2,000 casualties. In addition, both voluntary recruitment and the selective-service process continue to draw heavily on Puerto Rican youth.

Industrial Development

From the beginning of the industrial development program to the end of the fiscal year, approximately 180 new plants had been opened in Puerto Rico with the help of the Economic Development Administration. The calendar year 1951 alone showed an increase of $20 million in Puerto Rico's manufacturing output. The Transportation

Authority handled approximately 500,000 air passengers and 14,000,000 pounds of cargo at the San Juan airport alone, in addition to operating outlying airports, running the busses of the San Juan metropolitan area, and servicing ocean vessels at all ports of the island.

The list of new industries in the island includes a wide variety of industrial processes. Mechanized textile and leather operations are numerous among them; electric and electronic manufactures, light tools and appliances, various plastic products, chemicals and drugs, frozen foods, candy, sports goods, jewelry, paint, toys, and artificial flowers are also represented.

The Caribe Hilton Hotel, in which the Government of the Commonwealth had made a large investment, continues to be most successful. During its first 2 years of operation, 1950 and 1951, it returned $1 million to the Government of Puerto Rico as the agreed share of profit. The Governor has estimated that direct and indirect benefits of this enterprise to the economy of the island already exceed $6 million.

Changes in Sugar Production

The production of sugar in Puerto Rico increased from 1,286,000 tons in the preceding year to 1,375,000 tons in fiscal year 1952. As a result, even after sales on the world market, Puerto Rico has a large sugar carry-over which will have to be absorbed during the coming years. A very important increase of 170,000 tons in the Puerto Rico quota established in the extension of the Sugar Act by the Congress was secured largely through the work of the Department in cooperation with the Departments of State and Agriculture.

Puerto Rico Reconstruction Administration

Operations were financed from the revolving fund, in accordance with allotments by the President, as follows:

Operation and maintenance of housing projects	$248, 323
Operation of Castaner farm project	53, 658
Servicing of loans to cooperatives	9, 629
General administration	[1] 236, 721
Repairs to buildings, etc	116, 322
Construction of 250 latrines	12, 200
Replacement of unserviceable roofs	40, 800
Surveying and other services	15, 500
Seed-lending program	37, 947
Total	771, 100

[1] Includes $45,100 for liquidation activities.

Under the plan for continued liquidation of this Administration in an orderly fashion, the loans and notes receivable are being liquidated as rapidly as possible and the individual rural and urban housing units are being sold to the present occupants on a 20-year basis with the Government's interest fully protected by the deed-mortgage plan.

The Castaner farm produced $35,168.63 in excess of operation costs from the sale of diversified crops and furnished seasonal employment throughout the year to members of more than 200 resettled rural families. The sugar cooperatives, Association Azucarera Cooperativa Lafayette and Cooperativa Azucarera Los Canos had a successful grinding year and, in all probability, will grant a substantial bonus to their members as a result.

Meanwhile, essential projects for the fiscal year 1953 are being continued with allotments aggregating $776,600 out of the revolving fund. That fund, derived exclusively from PRRA operations, had a net available balance on June 30, 1952, of $3,146,307, of which $937,682 was collected during the fiscal year.

THE VIRGIN ISLANDS

Extensive hearings on H. R. 2644, a bill to revise the Organic Act of the Virgin Islands, were conducted by the House Subcommittee on Territories and Insular Affairs during January of 1952 in the islands and during March in Washington.

Following these hearings and further discussions between the Department and the subcommittee, a bill (H. R. 7393) was introduced in which were incorporated all the improvements and modifications on which the subcommittee had agreed. This bill was acted upon favorably by the House, but received no action in the Senate. It is expected that similar legislation will be introduced early in the Eighty-third Congress.

Development of Tourism

Tourism continued to be a leading and increasing economic activity during the fiscal year 1952 with full operation of the new hotels built during 1950 and 1951. A report by the Virgin Islands Tourist Development Board in June 1952 showed that actual employment in direct tourist facilities during the winter season involved a total of 1,636 employees on St. Thomas alone, or about 32 percent of that Island's labor force. Although the severe shortage of hotel facilities on St. Thomas and St. Croix has ended, additional recreational facilities are urgently needed to promote further tourist interest in the area. There are also good possibilities of developing St. John as a tourist center.

As the fiscal year closed, the Government of Denmark notified the Government of the United States of its intention to mark the one hundred and fiftieth anniversary of friendly diplomatic relations between the two nations by the gift of replicas of certain furnishings removed from Government House, Christiansted, St. Croix, at the time of the transfer of sovereignty in 1917. Portions of Government House were accordingly prepared for the installation of the replicas and, as the year ended, Governor de Castro and Danish Ambassador Kauffman were arranging for the event to take place August 4, 1952.

As had been jointly urged by the Departments of Interior and Agriculture, the Congress in Public Law 228 authorized the Department of Agriculture to expand its program in the Virgin Islands, particularly in the fields of extension and research, and appropriated $100,000 for this purpose. As the year closed, plans were being completed for beginning work under the new program.

The Virgin Islands Corporation

The Virgin Islands Corporation is a wholly owned Federal corporation the purpose of which is to promote the general welfare of the Virgin Islands through economic development. Toward this end it is primarily engaged in growing and manufacturing sugar, promoting tourism, developing land and water resources, making loans to commercial enterprises under circumstances where no other financing is possible, and operating the St. Croix power system. Toward the close of the year, the Congress also appropriated funds to enable the Corporation to take over the St. Thomas power system from the St. Thomas Power Authority.

The sugar operations resulted in a crop of approximately 11,600 tons of raw sugar and 441,600 gallons of molasses, the highest yield in many years. In spite of this improved yield, a financial loss was sustained, largely because the small size of the quota assigned to the Virgin Islands under the Sugar Act forced sale of roughly half the crop on the world market at a heavy loss. A small increase in the quota during the coming fiscal year, together with continuing operational improvements, is expected materially to reduce the loss.

Promotion of tourism was assisted by an appropriation of $30,000 to the Tourist Development Board to be used for other purposes than payment of salaries.

Under the land and water development program, two earth dams of 14 and 30 million gallons capacity, respectively, were constructed, while several existing smaller dams were constructed, improved, or repaired. Plans also went forward for 68 medium-sized dams to be undertaken early in 1953, and two new wells were dug which are producing satisfactorily. Brush clearance also went forward in cooperation with the Production and Marketing Administration of the Department of Agriculture, mapping operations were carried out, machinery was procured for large-scale grass seeding for land improvement and 3 acres were seeded by airplane to West Indian mahogany on advice of the Department of Agriculture's Forest Service.

Operation of the St. Croix power system was undertaken during 1952. Following authorization by the Congress, the Corporation paid off a prior loan from the Rural Electrification Administration, Department of Agriculture; acquired the St. Croix Power Authority's system; and established a Power Division within the Corporation. A substantial program of improvements was launched and a uniform, simplified rate structure was instituted with an over-all appreciable reduction in rates. At the same time, the Division operated at a profit for the year of approximately $11,000.

Public Works Program

Progress with public-works construction in the Virgin Islands during the fiscal year has been gratifying. The four hospitals at St. Thomas, St. John, Christiansted, and Frederiksted are well along in construction and should be completed before December 31, 1952. Telephone-exchange buildings have been completed for St. Thomas, Christiansted, and Frederiksted, and the other telephone communication facilities under construction, as well as the sea-wall improvements, are expected to be completed early in the next fiscal year. The water-supply catchment areas on St. John are expected to be completed before December 31, 1952.

Planned improvements to existing roads, with a few exceptions, have been completed in this fiscal year. The survey for the Center-line Road on St. John has been completed and construction of the road is expected to begin early in the next fiscal year.

Preliminary plans and specifications have been approved for the school program consisting of nine new schools and changes to seven existing schools. Final plans and specifications for the Christiansted Consolidated School consisting of a high and an elementary school, and improvements of the La Vallee Elementary School on St. Croix have been approved and bids for their construction will be opened August 28, 1952. Final plans and specifications for the Charlotte Amalie High School, and alterations to Madison, Herrick, and Monroe Elementary Schools on St. Thomas are expected early in the next fiscal year.

PACIFIC TERRITORIES

This was a year of historic significance throughout the Pacific Territories—marred only by the failure to grant Hawaii the statehood it so richly deserves. It marked the first year of civilian administration in American Samoa and in the Trust Territory of the Pacific Islands—a year during which these Territorial governments, despite severe financial handicaps, made important gains in economic, health, and educational fields while severing ties with the previous naval government. This was Guam's second year of civilian government under an organic act, and the first in its history under the United States without direct Federal subsidy. The progress made by all branches of the Government of Guam justifies fully the confidence of the Congress in the ability of the people of Guam to govern themselves.

Federal legislation and programs on behalf of our Territorial populations strengthen the bond between these strategic areas and the mainland and help maintain the respect and confidence of other free Pacific peoples in the United States.

HAWAII

Statehood Again Deferred

The Department, following the strong leadership of the President, concentrated its efforts for Hawaii on the enactment of statehood legislation, which was again introduced early in the Eighty-second Congress and later amended to take account of the adoption by the people of Hawaii of a State constitution, which their elected representatives had drawn up in accordance with procedures outlined in previous statehood bills. Administration and congressional leaders decided to focus their efforts on obtaining Senate approval of the legislation in the knowledge that the House would overwhelmingly approve the measure as it has in previous Congresses.

The Senate's action on the Hawaii bill became unavoidably dependent upon approval of the Alaska statehood bill when the Senate decided to consider the Alaska bill first. Unfortunately, the Senate elected, by the narrow margin of one vote, to send the Alaska statehood bill back to committee for further consideration, and Hawaii as well as Alaska statehood was again postponed.

Legislative Gains

The Department's legislative program for Hawaii was, except for statehood, very successful. In cooperation with the Delegate and the Governor of Hawaii, the Department pressed for and obtained legislation to compensate the Territory for its care of leprous patients; to remove, with appropriate safeguards, unrealistic restrictions on the port handling of commercial explosives, to amend the organic act as recommended by the Territorial legislature, and to authorize bond issues for public improvements. An essential measure on which legislative action was not concluded was the authorization of Federal funds for water-resources investigations. Several urgently needed flood-control projects, deferred in accordance with the President's economy program, as well as a project to construct a barrier to protect the city and harbor of Hilo from destruction by lava flows from Mauna Loa volcano, should be undertaken as soon as conditions permit.

Through Federal legislation and executive action, a number of areas no longer required for military use were restored to Territorial use and control. The Governor's land-use committee, established by direction of the President and composed of representatives of the Armed Forces and Territorial agencies, submitted its final report indicating agreement on the disposition of areas, with the exception of six on which further consultations are being held.

Economic Recovery

Increased military defense activities since the outbreak of the Korean war have enabled Hawaii to recover from the economic slump into which it had fallen following demobilization at the end of World War II. Meanwhile, the Territory sought to free itself from excessive dependence on military spending and to meet the demands of a growing population by increasing and diversifying its agricultural production, by promoting the development of new industries, and expanding its tourist trade.

Despite a costly strike in the pineapple industry, labor-management relations within the Territory showed marked improvement. However, a maritime strike tied up west-coast shipping from May 26, 1952, until mid-July, emphasizing the fact that the Territory has suffered from similar disputes for almost a decade. Some solution must be found which, while fair to both labor and management, recognizes the paramount public interest in the continuance of transportation during labor disputes.

The Secretary of the Interior participated with Vice President Barkley in the Territory's celebration of Pearl Harbor Day. The Secretary visited most of the islands in the Hawaiian group, discussed with Territorial leaders the means of promoting Hawaii's development, and made several major addresses.

GUAM

The Department, though responsible by statute only for supervision of the relations between the Federal Government and the government of Guam, takes pride in the accomplishments of the Territorial government and in the manner in which our citizenry on Guam has fulfilled its national-defense and other civic obligations.

The Territorial civil-service system instituted last year was strengthened by the establishment of an effective retirement system. Many of the Department heads and more than 90 percent of the employees of the Territorial government were recruited locally. A land-management and planning program has been established based upon an excellent statute. The judiciary has been reorganized under a statute which accords with recommendations made by Judge Albert B. Maris of the United States Court of Appeals for the Third Circuit. Under this statute, the District Court of Guam, which has the jurisdiction of a district court of the United States, has been given certain local jurisdiction as well.

Additional authority has been granted to the Board on Utility Rates in regulating the operation of public utilities. The Governor's long-range public-improvement program was adopted by the legislature, and plans are being made for the construction of new schools, a new hospital, and expansion of power facilities. A juvenile-court law was passed providing for an enlightened system for handling juvenile delinquents. A civil-defense program has been instituted. A College of Education to train teachers has been established on Guam in cooperation with Ohio State University. A Guam Finance and Development Administration has been created and provided with a revolving loan-and-guaranty fund to assist local farmers and businessmen. All these and many other actions of the Guam government reflect the magnitude and fundamental character of the tasks which confronted the new civilian government.

Civil Rights

A substantial civil-rights gain was achieved when Governor Skinner removed the requirement of many years' standing that United States citizens must first obtain the Governor's permission before entering Guam. Prior permission of the Secretary of the Navy is, however, still required as a security matter under Executive order. The Territorial legislature repealed previous laws prohibiting intermarriage between persons of different races.

Toward a Housing Program

The Office of Territories arranged for a team of Federal housing experts to study housing needs on Guam. Upon conclusion of the survey, the Office cooperated with the National Housing Agency in obtaining enactment of the necessary legislation as part of the Housing

Act of 1952. Before the end of the year, steps had been taken to establish Federal home-loan and mortgage-guaranty facilities on Guam. The need for housing is urgent and will require the best efforts of the Federal and local government if it is to be met.

Immigration and Tax Problems

Extended discussions held with the Immigration and Naturalization Service resulted in the Service establishing a station on Guam and undertaking to enforce those United States immigration laws which are applicable.

The authority of the government of Guam to levy and collect income taxes was upheld by the District Court of Guam in a suit brought by a taxpayer who challenged the Territorial government's authority to levy and collect income taxes under the provision of the organic act which states that the income-tax laws in force in the United States shall likewise be in force in Guam. The case is now on appeal to the United States Court of Appeals from the Ninth Circuit and will be heard in the fall.

Other Technical Assistance to the Territory

The Department sent a representative to Guam as a member of an interdepartmental group to study certain Federal problems involved in the employment of alien Filipinos on Guam. Recommendations were made looking to the protection of Guamanian workers from the competition of imported workers who are paid relatively low wage rates, the enforcement on Guam of the Fair Labor-Standards Act, and the enactment of a local minimum-wage law. Arrangements were made by the Department for the assumption by the Department of Agriculture of direct responsibility for enforcement of Federal plant and animal quarantine regulations. Two experts were sent to Guam by the National Park Service to advise on plans and programs for community recreation and for conservation of historic sites and monuments.

The Public Administration Service of Chicago completed its study of the organization of the government of Guam. This was the last of four such studies financed from the President's Management Improvement Fund, which were contracted for by the Department after consultation with the Territorial government.

The seven-man commission which was appointed by the President under the organic act submitted its report to the Congress with recommendations as to which laws applicable to Guam on August 1, 1950, should be declared inapplicable and which laws not applicable on that date should be made applicable. Most of the Commission's recommendations were incorporated in an omnibus bill (H. R. 6808) on which hearings were held in the House but no action taken. Other recommendations were either embodied as amendments to pending legislation and in certain cases enacted or were submitted as separate legislative proposals. The Commission's recommendations provide the basis for the Department's legislative program for the Eighty-third Congress.

Public Domain Transferred to Island Control

Of outstanding importance in the rehabilitation of the island community was the transfer by the Secretary to the government of Guam of all public-domain land under departmental jurisdiction, comprising some 30,000 acres. This arrangement was qualified by the proviso that none of the land should be alienated for other than rehabilitation or homesteading purposes without prior approval of the Secretary.

Further Developmental Programs Needed

Much remains to be done on Guam to enable the Territory to realize the full potentialities of its human and natural resources. Food production must be accelerated, and manufacturing enterprises should be greatly expanded to meet local needs. Public and private construction is urgent. Further improvement in educational, health, and other public services are needed. The government and people of Guam can be expected to undertake most of these developmental programs on their own initiative with the resources now available to them. They will, however, need some assistance from the Federal Government, principally through proper extension of Federal laws and services as recommended by the President's Commission, and the transfer to the Territorial government of lands controlled by the Armed Forces which are no longer required for military purposes.

AMERICAN SAMOA

By Executive Order 10264, responsibility for the government of American Samoa was transferred from the Secretary of the Navy to the Secretary of the Interior on July 1, 1951. The first act of the Secretary was to define the Department's relationship with the Territorial government and to outline in broad terms the Department's policy. Under that order, executive authority within the Territory is vested in the Governor and other officials appointed pursuant to law and is exercised under the supervision and direction of the Secretary of the Interior. The Governor has been delegated legislative authority under the supervision and direction of the Secretary except that no measure affecting the power of the Fono (the local legislative advisory body) or the judiciary may become effective without the approval of the Secretary. The Secretary appoints the chief justice, and judicial authority is established independent of the executive and legislative instrumentalities of the government.

Within the Territory, the replacement of naval personnel was concluded within the first few months. Public services continued uninterrupted throughout the transition, despite financial and other restrictions, and by the end of the year rapid progress had been made in establishing a sound foundation for government in the future.

Complex wage and personnel problems were inherited from the previous administration. To meet these problems, as well as that resulting from the Civil Service Commission ruling that Stateside employees could not be considered Federal employees, the Department contracted for a comprehensive personnel survey with Research Associates of Hawaii, and the classification, compensation, and merit system resulting from the study has been established, thus providing a sound basis for employment in the future. A retirement plan was also drawn up for installation during the ensuing year.

Another pressing problem that required solution was the establishment of an effective system for accounting and fiscal control, including accounting for accrued obligations and revenues which had not been done previously in the Territory. Representatives of the General Accounting Office made a survey of the situation and assisted in the installation of a new accounting system.

The Department sponsored a survey of the medical problems and program in American Samoa by an official of the United States Public Health Service. Arrangements were also made for the United States Labor Department to send an expert from the Hawaii Employment Service to survey the availability of Samoan workers for employment in Hawaii and on the mainland and to establish a regular system for reporting the availability of such workers. In addition, the Department sponsored a survey of the Territory's judicial system by Judge Albert B. Maris. His recommendations will serve as the basis for legislation at both local and Federal levels to improve the functioning of the judiciary and to provide for appeals into the Federal court system.

While these surveys of basic administrative problems were progressing, the government of American Somoa was pushing forward, as rapidly as its limited budgetary position permitted, to meet the urgent problems of a rapidly increasing population.

As part of a stepped-up educational program, 14 new schools and 12 living quarters for teachers were built by village labor. The 4,162 students enrolled in private and public schools during 1951 increased in 1952 to 5,018, of whom 3,898 were in government schools. An outstanding development in the education field was the establishment of the Feleti Memorial Teacher-Training School, which will be operated on both governmental and foundation funds to provide expert instruction to graduates of the high school.

The small number of professional public health personnel in Samoa made notable achievements in the past year. A program for local treatment of leprous patients was inaugurated which, however, must be expanded to care for patients now being treated at a British leprosarium in the Fiji Islands. A program to immunize the entire population against typhoid and smallpox was instituted and, in addition, 9,000 children were immunized against diphtheria, whooping cough, and tetanus. A high light in the dental program was the intensive treatment of the population on Swains Island, 200 miles north of the capital of American Samoa.

Agricultural progress was made during the year with the importa tion and distribution for planting purposes of selected superior-strain coconuts and cacao pods, and of a large variety of truck-garden crop seed for testing purposes. Programs for improvement of cattle and poultry breeds and for the control of insects are in progress.

Industrial activity in American Samoa consists only of the production of local handicraft items, which, with the government's assistance in marketing, provides a modest cash income for many families otherwise dependent wholly upon subsistence farming. Steps are now being taken for the Government of American Samoa to offer for lease a fish cannery which was purchased in order that its employment and income potential would not be lost to the people through its sale for export from the territory.

Much still remains to be done in American Samoa. Continued attention is required for the development of the local legislative advisory body, the Fono, to bring it to the point where it can assume legislative powers. Serious attention must be given to the problems resulting from population growth. Due to the limited amount of arable land, improvement of agricultural production and development of new industries are urgently needed. Better transportation, both surface and air, is a vital necessity if the economic situation in Samoa is to be substantially improved.

TRUST TERRITORY OF THE PACIFIC ISLANDS

The formal transfer of responsibility for the Trust Territory of the Pacific Islands to the Secretary of the Interior took place July 1, 1951, pursuant to Executive Order 10265. This was followed by an order of the Secretary of the Interior similar to that for Samoa, delineating the extent and nature of the authority of the Government of the Trust Territory and prescribing the manner in which relationships of the Government with the Congress, with other Federal agencies, and with foreign governments and international bodies are to be established and maintained.

As was anticipated, a major task during the first year of responsibility for the Trust Territory was in completing details of the transfer from the Department of the Navy. Fortunately, prior to the transfer, arrangements had been satisfactorily completed to provide communications, air service, and other necessities of government for this vast area. Civilian administration of the shipping service was established on August 1 and replacement of naval government personnel with civilians was completed during the ensuing 2 months.

With the basic framework and needs of the government thus established, attention was directed to improving the services, functions, and program of the government. A new accounting system was established and was reviewed and approved by the General Accounting Office. A survey was also arranged with the United States Public Health Service of the medical and public health programs of the territory. There is urgent need for funds to improve hospital facilities.

Judge Albert B. Maris made a study of the judicial system in the territory and his recommendations are being placed in effect. The General Accounting Office detailed two of its experts to review the functioning of the Island Trading Co. and at the close of the year a further study of the company was under way by an economic consultant to the territorial government to recommend what the future of that government-controlled corporation should be. Through the company's handling of copra marketing and the operation of a copra stabilization fund, maximum returns are ensured to producers and the shock of sharp fluctuations in world prices lessened.

Trust Territory officials restudied the surface transportation problem with a view to adapting the service more closely to the needs of the Territory and reducing costs. They recommend that the six former Navy AKL ships be replaced with schooner-type vessels and that a large vessel, in addition to the former Navy AK now in use, be acquired to provide direct service between District centers and the west coast mainland. Almost 200 islanders, employed on these vessels, are obtaining valuable experience and broadening through travel in the area and occasionally to foreign points.

Financial and related economic problems of the Trust Territory were the source of almost all of the difficulties encountered by the territorial government. The heavy cut by the Congress in the amount requested for the fiscal year necessitated constant assessment of expenditures in order to ensure that the most urgent of the many needs was always being met. The Congress did not approve supplemental budgetary requests through which it was hoped to alleviate shortages in supplies and to replace worn-out facilities in order to end the constant flow of funds into the repair of such facilities.

Nevertheless, the Trust Territory Government has maintained a satisfactory record of administrative achievement. There has been increased participation by islanders in local government. The total of regional advisory bodies was increased to four with the approval of a charter for the Congress in the Ponape District. Local Micronesian sheriffs have taken over responsibility for island law enforcement and the High Commissioner has appointed 21 islanders as justices of District courts.

The arrangements made at the time of the transfer to send some fifty islanders to the Central School of Medicine at Fiji have proved very satisfactory. The first graduates have assumed responsible positions in all of the six districts. Two Micronesian medical practitioners were sent to Hawaii for training in ophthalmology and a new class of nurses completed training at the Guam Memorial Hospital. On Saipan, selected men were trained as X-ray technicians and a new hospital for the insane was opened. Sanitation measures have been improved through wider acceptance of insect- and rodent-control measures and better understanding of waste disposal problems.

In education, 141 elementary and 6 intermediate schools and the Pacific Islands Central School were maintained in full session, in addition to courses in adult education. There has been an integration of school and community activities, an expansion of in-service training of local teachers, and the development of more effective curricula and text materials in local languages and in English.

Efforts to develop the economy have been directed not only to improvement of present crops such as copra, but also to the introduction of cacao, to the accelerated production of high-grade poultry, and to the development of a cattle industry in the Northern Marianas. Copra sales will be greatly fostered by the passage of Federal legislation which makes the two cent internal revenue tax on the first processing of coconut oil inapplicable to oil produced from Trust Territory copra.

Negotiations with the Japanese Phosphate Mining Co. and Japanese Government officials led to the continuation of phosphate mining on Angaur Island under favorable conditions. Consideration has been given to the advisability and practicability of mining bauxite deposits on Babelthuap Island. The Trust Territory Government has received a substantial return from the sale of war-generated scrap and has taken steps toward contracting for the salvage of sunken vessels in Trust Territory waters.

A complete and detailed review of the administration of the Trust Territory is undertaken each year by the Trusteeship Council of the United Nations. During the year, the Department collaborated with the Department of State and the High Commissioner in presenting the annual report for the year ending June 30, 1951. This report, as in the case of previous years, was well received by the Council, which noted "with satisfaction the transfer of authority to civilian administration without any disruption of the various services."

Organic legislation, which was introduced in both the Eightieth and Eighty-second Congresses but which was not acted upon, remains a pressing need in order to establish by law the basis of the civil government and the rights and duties of the inhabitants of the territory. Also of importance is the need for establishing the headquarters of the government within the territory. The present arrangement, with headquarters in Hawaii, is recognized by all as being far from satisfactory. Another pressing need, as previously mentioned, is for funds to replace worn-out and wholly inadequate facilities and accommodations. Their constant breakdown and repair is a wasteful drain of time and money. Their replacement would not only save money but permit officials to devote their time more profitably to the substantive tasks of administration.

OTHER PACIFIC ISLANDS

The Office of Territories laid plans for providing education to children on Canton Island and continued to carry out its responsibilities in the Equatorial Islands. It also consulted with the Department of State on matters pertaining to disputed islands in the Pacific.

DIVISION OF GEOGRAPHY

Meredith F. Burrill, Director

The Division of Geography was established to discharge the duties of the Secretary of the Interior with respect to the act of July 25, 1947, which established the Board on Geographic Names. The Division performs research and other staff functions relating to the standardization of geographic names.

Virtually all of the Division's work in 1952 was concerned with areas outside of the continental United States. Geographic and linguistic research preceded the standardization of more than 150,000 geographic names for the use of Federal agencies. Over 5,000 individual name decisions were processed. More than 200,000 tabulating cards were punched for publication in gazetteers, and well over 400,000 names were edited on maps and in text for correctness of spelling and accuracy of application. The Division's inquiries service supplied 15,000 names to users by telephone and mail.

Most of the above data indicate increases over 1951, reflecting added responsibilities undertaken by the Division in the standardization of names for military maps of foreign areas.

Concurrently with the appointment of a special Advisory Committee on Arabic and Persian, the Division initiated systematic staff research as a basis for romanization of names from Arabic and Persian sources.

UNITED STATES BOARD ON GEOGRAPHIC NAMES

The Board on Geographic Names is an interdepartmental organization established for the purpose of standardizing geographic nomenclature for use by the Federal Government. Representatives of 11 Federal departments and agencies make up its membership. Rear Adm. K. T. Adams (retired) became chairman during the fiscal year 1952.

The Board and its committees held frequent meetings during the year to act on policies, names, publications and related matters. Basic foreign name policies were considerably extended to cover new areas and additional matters in areas previously covered. The volume of the Board's activity is reflected in the statistical data included in the report of the Division of Geography.

The Board issued a revised Catalog of Publications and decision lists for Burma, Thailand, China and associated areas, Malaya and Singapore, Indochina, Guatemala, and Alaska.

The Advisory Committee on Antarctic Names virtually completed its recommendations for standardizing the names in that area that have been used or proposed, and the Advisory Committee on Names in Alaska continued to review and furnish recommendations on Alaskan name problems. A new Advisory Committee on Arabic and Persian was created to provide expert technical advice on names derived from Arabic and Persian sources.

DIVISION OF INTERNATIONAL ACTIVITIES

Joseph C. McCaskill, Director

The Secretary created the Division of International Activities on November 24, 1950, by Secretarial Order No. 2598. In his memorandum to the heads of bureaus and offices with respect to the establishment of the Division the Secretary stated:

> The increasing responsibilities of the department in resource conservation and development require that greater emphasis be placed on our activities in the field of foreign policy and programs, both in the Office of the Secretary and in bureaus and offices concerned.
>
> The need for this emphasis stems from two developments: First, the reorganization of the Department of State envisaged dependence by that Department on technical agencies of the executive branch for commodity and other such specialized support * * * The Executive Order of the President of October 13, 1950, including this Department in the administration of the Trade Agreements Program, is a concrete example of this enlarged responsibility.
>
> Second, the Point 4 Program * * * has been enacted and the procedures for its administration depend largely upon the work of action agencies such as the bureaus of this Department. This program presents a challenging opportunity to use our experience and knowledge as a natural resource agency to cooperate on projects in those areas where resource development and management is the key to raising living standards.

The creation of the Division of International Activities represented a stepping-up of existing operations by the Department rather than a new venture into uncharted waters. In the discharge of its domestic responsibilities, Interior had, over the past decade, been increasingly concerned with their relationship to international affairs. Consideration had to be given to the impact of United States programs, such as stockpiling and allocation of scarce materials, on the economies of friendly foreign powers. Reciprocally, the pertinent international factors, as for example, Japanese tuna production, had to be assessed before Interior could frame its domestic programs. Thus, in many of the resources fields of concern to the Interior Department, there can be no isolated domestic programs; rather, they become domestic aspects of free-world programs.

The Division of International Activities seeks to interpret to the Department the reciprocal interrelationship of departmental activities and foreign affairs, to foster cooperation and consistent action among the foreign operations of the bureaus and offices in the Department, and to serve as the focal point of contact of the Department with other agencies in the international field.

This reporting year is the first complete year of activity by the Division of International Activities. The Division conducted its operation during fiscal year 1952 with a total staff of 12, including professional and clerical personnel.

Since the establishment of the Division, the Department's participation in international activities has been highlighted by:

A formal visit by the Secretary of the Interior to Venezuela and Mexico, important suppliers to the United States of petroleum, iron ore, and other minerals.

Representation on the International Tin Study group, the United Nations Commodity Conference on tin, and the United States Tin Mission to Malaya.

Participation in the Tariff Negotiating Conference of the General Agreement on Trade and Tariffs, and in the United States-Venezuelan trade negotiations.

Participation in the fishery treaty with Japan.

A considerable increase in the Department's role in the Point Four program.

Leadership in the study and preparation of recommendations submitted by the United States to the Economic and Social Council of the United Nations designed to improve international activities in the field of water control and utilization.

SUMMARY OF ACTIVITIES—1952

Point 4 and Other Technical Assistance Programs

In cooperation with the Technical Cooperation Administration (TCA) of the Department of State, and the Mutual Security Agency (MSA), the Department of the Interior is providing assistance to the Governments of an increasing number of countries in planning for the long-range development of their natural resources.

In this connection, the Division of International Activities undertook negotations during the year with TCA and MSA in an effort to develop working agreements with these agencies which would assure an adequate and effective role for the Department of the Interior in all phases of technical assistance in the natural resources field. This would include planning and programing, carrying out of assistance projects in the field, developing effective training programs for foreign nationals, and providing advice and assistance to both TCA and MSA officials in assessing the role of natural resources assistance in the over-all technical cooperation program.

As a result of the negotiations, a training agreement has been completed with MSA and a projects agreement is nearing conclusion. Agreements both on training and field projects are under negotiation with TCA.

To facilitate the development of departmental positions on the agreements mentioned above, and on other major policy, organizational, and procedural problems, the Division established a departmental working group consisting of representatives of the interested agencies of the Department. Meetings of this group with officials and specialists of TCA, MSA, and appropriate United Nations agencies were arranged by the Division, in order to facilitate coordination between Interior Department bureaus, other agencies of the Government, and the international agencies.

Members of the staff of the Division represented the Department on the Inter-departmental Advisory Council on Technical Cooperation, the principal interagency advisory group to the Administrator of TCA, and on similar interagency groups concerned with major problems related to both bilateral and multilateral technical assistance programs.

The Division received from TCA and allocated $2,615,944 to the bureaus and offices of the Department for their participation in the Point 4 program during fiscal year 1952. Within that period, the Department had 112 specialists in the field giving cooperative assistance to 26 TCA countries. In anticipation of a satisfactory working agreement with MSA, the Department also undertook a number of foreign technical assistance projects for MSA, sending 35 specialists to 8 MSA countries. Also, a technician was sent to one country for the United Nations.

In addition to the above, 10 Department of the Interior specialists were sent on request to 5 countries at the full expense of those countries.

The training of foreign technicians and leaders in modern methods of natural resource development and the orientation of foreign official observers in the Department's functions, operations, and field activities was an important phase of the technical assistance programs during the year.

In some instances, full training grants were awarded by TCA, MSA, other State Department programs, or the United Nations. In other cases, the foreign governments concerned provided the funds.

In this phase of the work, the Department gave specialized training to 249 technicians and leaders from TCA countries, and orientation to 78 official observers from those countries. Training was given to

62 trainees and leaders from countries where MSA operates, while 97 officials from those countries came to observe and study Interior's natural resources programs. Also, the Department trained 62 foreign technicians, sponsored by the United Nations, and received two official observers under the U. N. In addition, 7 Japanese nationals, sponsored by the Department of Defense, were received by the Department as trainees or observers.

United Nations and International Conferences

The United States, in the last fiscal year, took the leadership in the United Nations Economic and Social Council to bring about a greater degree of coordination among the various international agencies working in the field of water control and utilization.

By request of the United Nations Economic Committee, the principal United States Federal interagency committee concerned with United States policy and activities for the United States delegation to the United Nations Economic and Social Council, the Department took the responsibility of chairing an interagency working group to review the work of international organizations engaged on water problems and to make recommendations thereon. The group was established in February 1951 with the Director of this Division as Chairman, and the staff of the Division acting as secretariat.

The above group's first major report recommended policy guides with respect to the water activities of the United Nations, the Food and Agriculture Organization, and other international organizations. It also urged establishment of a central staff in the United Nations Secretariat to provide technical leadership and to assist in coordinating the work of the various United Nations agencies with respect to their water programs.

The United States delegation embodied these recommended points in a proposal to the United Nations Economic and Social Council which accepted them by resolution in its 1952 session. In this connection the Director of the Division served as advisor to the United States delegation.

Through the Division, the Bureau of Land Management and other interested bureaus, the Department actively participated in developing United States policies with reference to land tenure. The Department participated in the first World Conference on Land Tenure, at the University of Wisconsin, in the fall of 1951. Officials of the Department presented papers and took an active part in the meetings. Agencies of the Department are cooperating with the United Nations Food and Agriculture Organization in the planning and programing of its forthcoming Latin-American Conference on Land Utilization to be held in Brazil early in 1953.

The Department of the Interior has long recognized the importance of international conferences and seminars as a means of exchanging ideas and technical knowledge with other friendly nations. For example, the stimulating effects of one such conference—the United Nations Scientific Conference on Conservation and Utilization of Resources, initiated and planned by the Department and held in 1949—continue to be evident. As a result of it, an increasing number of requests come from the governments of the lesser developed countries for conferences and seminars on the appraisal and development of natural resources.

International Trade and Materials Production

International stimulation of materials production and trade were of key importance to the United States and the other free nations of the world during 1952. The Department of the Interior's concern and responsibility in connection with strategic materials and other commodities increased the Division's active participation in a number of negotiations in this field.

In October 1950, the Department became a member of the Trade Agreements Committee (TAC) and the Committee for Reciprocity Information. Since then the Division has represented the Department on these Committees. The Interior representative joined TAC in Torquay, England, during the Tariff Negotiation Conference conducted by the General Agreement for Trade and Tariffs. Later, the Division supplied a representative on the United States Team for Renegotiation of the United States-Venezuela Reciprocal Trade Agreement, which dealt largely with petroleum and iron ore, commodities of vital concern to Interior.

Staff members of the Division also represented the Department on the following interagency groups during the year:

The Advisory Committee on Export Policy, which is responsible for advising the Secretary of Commerce on the control of exports from the United States.

The Economic Defense Advisory Committee, which advises on policy and administration of the Battle Act of October 1, 1951. This act provides for the cessation of economic, financial, and military aid in the event that recipient countries fail to cooperate in controlling shipments of critical and strategic materials to the Soviet orbit.

The Foreign Supplies and Requirements Committee, concerned with the establishment of United States policies and programs to assure adequate production and equitable distribution of materials in short supply.

The Foreign Facilities Committee, which advises the National Production Authority on allocation of scarce materials and equipment to foreign claimants.

Since the Division's role is principally one of dealing with policy and coordination, the main burden of preparing for such interagency representation and international negotiation and of dealing with interim problems falls on the Department's bureaus. Therefore, the Division set up work groups within the Department to enlist the bureaus in supplying the information and recommending courses of action to the departmental representatives. As a consequence, in the Fish and Wildlife Service and in the Government of Puerto Rico, action is under way to expand their facilities for dealing with foreign trade.

In connection with the activities noted above and other international matters affecting the Department, the Division participated in the preparation of legislation and executive orders and prepared or reviewed Interior reports thereon. Approximately 50 proposals were handled by the Division during the fiscal year.

The expanding role of the Department of the Interior in international affairs has also increased substantially the Department's requirements for economic information from the Foreign Service. The Division was assigned the responsibility of assisting the Division of Foreign Economic Reporting, Department of State, in an evaluation of the current informational requirement needs of this Department. During the year, the Division has coordinated the data requirement needs of the interested offices and bureaus and has served in a central liaison and coordination capacity in a critical review of 21 individual country economic reporting programs.

LOOKING TO THE FUTURE

With the release of the Report of the President's Materials Policy Commission as the fiscal year came to an end, the Department began preparing itself to assume the broader role in foreign minerals which the Commission recommends. The Division has devoted itself to studies of the appropriate functions for planning and operating a foreign minerals program which has as its objective the assurance of adequate flow of minerals to the United States and the free world.

The report of the Commission calls for collection and analysis of statistics and information on foreign minerals in considerably greater volume than presently. Supplies and requirements in each commodity need to be appraised and projections should anticipate the supply-demand situation in future years. Specific objectives for production of minerals in each country will be outlined and various methods recommended for meeting these objectives, including among others international commodity arrangements, technical assistance, tariff and tax concessions, investment treaties, loans, and procurement contracts. Similar action in the water and land fields will follow in due course.

OFFICE OF THE ADMINISTRATIVE ASSISTANT SECRETARY

Vernon D. Northrop, Administrative Assistant Secretary

By virtue of the delegation of the authority of the Secretary of the Interior in the field of administrative management to the Administrative Assistant Secretary, this Office provides integrated direction of the functions of the Department in that field. The Office is comprised of the immediate office of the Administrative Assistant Secretary and five divisions, viz, Budget and Finance, Property Management, Personnel Management, Management Research, and Administrative Services.

A report for each division follows:

DIVISION OF BUDGET AND FINANCE

D. Otis Beasley, Director

The Division of Budget and Finance is responsible for the general direction and supervision of financial and budget functions of the Department. Its responsibility also extends to the investigation of alleged irregularities. The Division also has the responsibility for budget and finance functions as related to the defense agencies for which the Secretary has been designated the responsibility under the Defense Production Act of 1950. The organization of the Division consists of the Office of the Director and three branches covering budget, finance, and investigations.

The Interior Appropriation Act for 1952 contained appropriations amounting to $511,841,816. An additional $22,034,400 was obtained through supplemental appropriation acts, making a total of $533,876,216 appropriated to the Department. Of this amount $5,235,000 was made available in supplemental appropriation acts for meeting the cost of operating the emergency defense activities for which the Secretary was designated the responsibility under the Defense Production Act of 1950.

The Budget Branch is responsible for developing general budgetary policies, devising methods and standards to guide the preparation of budget proposals by the bureaus, and analyzing the proposals in relation to the Department's over-all budget programs. The Branch also supervises and participates in the presentation of the Department's estimates before the Bureau of the Budget and the Congress. Problems involved in accomplishing the complete unification and simplification of the Department's budget, as well as of achieving uniformity and improvement in the budget presentations of the bureaus, have continued to require the attention of the budget staff. During the coming year efforts will be devoted to further improvements in budget presentations so as to permit a better understanding of the purposes for which appropriations are requested.

The Branch of Finance continued to participate actively in the joint program of the Bureau of the Budget, Treasury Department, and the General Accounting Office for improving accounting in the Federal Government. Continued consideration has been given to the provisions of section 113 (a) of the Budget and Accounting Procedures Act of 1950, as concerns the establishment of effective control and accountability for all funds available to the Department. An internal audit program has been inaugurated in the bureaus and offices of the Department, the extent of such program being limited to the funds available for such purpose in the fiscal year 1953. The bureaus and offices of the Department established a system of administrative control under departmental regulations issued pursuant to section 1211 of the General Appropriation Act, 1951, so as to (*a*) restrict obligations or expenditures against each appropriation to the amount of apportionments or reapportionments made for each such appropriation, and (*b*) enable the Secretary to fix responsibility for the creation of any obligation or the making of any expenditures in excess of an apportionment or reapportionment.

The Branch of Finance has effected a work arrangement with the General Accounting Office with respect to its comprehensive audit program. All bureaus and offices will be covered by such an annual audit program effective for the fiscal year 1953 with the exception of two bureaus of the Department; certain areas under the jurisdiction of the Office of Territories and the Office of the Secretary.

The Branch of Finance with the cooperation of the General Accounting Office prescribed procedures and installed complete accounting systems for the Southwestern Power Administration, Southeastern Power Administration, Bureau of Indian Affairs, the Alaska Road Commission, and the Government of American Samoa. Further the Branch of Finance with the cooperation of the Accounting Systems Division of the General Accounting Office continued to assist and cooperate with the bureaus and offices to improve their accounting systems, particularly with respect to the accounting systems of the Bureau of Reclamation, Bureau of Land Management, Bureau of Mines, Government of the Trust Territory of the Pacific Islands, and the Alaska Railroad.

The Branch of Investigations conducts investigations of alleged irregularities in the performance of official duties by employees of the Department; investigates alleged fraud and conspiracy in the sale and exchange of valuable timber lands held in trust for Indians and investigates complaints of unlawful trading with the Indians; conducts investigations of other miscellaneous matters under the jurisdiction of the Department for the purpose of obtaining information on which to base administrative decisions. When possible criminal offenses are indicated in the reports, such matters are referred to the Department of Justice for determination of possible institution of criminal proceedings.

DIVISION OF PROPERTY MANAGEMENT

N. O. Wood, Jr., Director

During the second complete year of operations, notable progress has been made in the management of the Department's records and its property by the Division. An extremely close liason has been established with the bureaus and direct channels have been opened from the level of management down to the small field offices of the bureaus.

The Division continued to assume responsibility in the field of priorities. The regular bureaus and agencies were assisted in their efforts to obtain needed material through the use of priority ratings, directives, location of new sources of supply, and so forth. The Division also worked in close cooperation with other agencies of the Government charged with responsibility under the Defense Production Act of 1950, the Renegotiation Act, the First War Powers Act, and other applicable laws or regulations. In the third quarter of the fiscal year, the supply picture had improved materially and few bureaus were having difficulty in obtaining material, equipment, or supplies needed for their operations. Later, a temporary set-back was caused by the steel strike.

Regulations have been issued which permit the establishment of Imprest Fund Cashiers in the bureaus and agencies. Under this new, improved procedure, purchases up to $50 can be made for cash, thus dispensing with the vouchering procedure which has been a handicap to the bureaus in dealing with merchants in small towns.

The Division has worked in close cooperation with GSA in revising and simplifying various standard forms in use by procurement offices of the bureaus in order that the forms could more adequately serve the purposes for which they were designed. Although improvement was not restricted to that field, continued attention to the small purchase problem has substantially reduced the number of small orders written, with a resultant saving to the bureaus concerned.

In the field of utilization and disposition of property, the Division was primarily responsible for a number of worth-while accomplishments. One of the primary accomplishments was the development of a Manual of Allowances for Quarters, Subsistence, and Services for the bureaus and agencies in the 48 States and the District of Columbia. This manual has proved to be a very worth-while regulation; it serves to equalize payments made by personnel of the bureaus and agencies to whom Government quarters are made available, as compared to payments made for private quarters.

The Division cooperated with other departments and agencies in developing a series of interdepartmental motor equipment field conferences for promoting sound management of motor vehicles and construction equipment. It established a uniform method of identification of motor vehicles owned by Interior bureaus and agencies. There were other allied problems in the field which necessitated action from departmental level. Progress has been made in developing certain standards which greatly increase the effective utilization of property and, at the same time, tend to establish appropriate safeguards considered desirable. Standards were developed for Interior agencies to use in granting approval for employees to domicile Government-owned passenger motor vehicles. Other standards were developed governing the sale of Government property to Government employees, and detailed instructions for the distribution of excess property between the agencies of the Department. It also developed a scrap metal disposal program to assist the defense effort.

The departmental records management program has made progress in several areas. The field installations of the various bureaus have begun to utilize the facilities of the Federal records centers to store inactive records with resultant release of valuable office space and filing equipment. As of June 30, 1952, this Department had transferred more than 32,000 cubic feet of records to Federal records centers; in terms of floor space and filing equipment released, these transfers reflect a potential gain of 32,000 square feet of space and approximately 4,500 filing cabinets.

The services of GSA analysts have been secured to assist the bureaus in preparing bureau-wide records control schedules so as to insure systematic and prompt disposition of inactive records throughout the Department; work in this area has already begun in two bureaus and, in one of them, more than 7,800 cubic feet of records have already been transferred to the Federal records centers. In addition, a GSA analyst reviewed the operations of the Secretary's Files Section and other files installations in the Office of the Secretary and recommended adoption of a streamlined files classification system which was approved and is in the process of installation.

The departmental program for protection of the indispensable operating records was placed in effect and is coordinated by the Division. Funds were obtained from GSA to enable the Bureau of Land Management to microfilm all of its more than 6 million patent records and more than 50 percent of its survey notes. GSA also assisted in microfilming indispensable operating records of the Office of the Secretary, the Solicitor's Office, and the Geological Survey.

Technical assistance was provided to two of the bureaus in initiating forms control programs and to another bureau in setting up a central reporting system.

DIVISION OF MANAGEMENT RESEARCH

Arthur B. Jebens, Director

The second year under Reorganization Plan No. 3 of 1950 was one of consolidation and adjustment as the reorganized administration of the Department began to make itself felt in day-to-day operations. During this adjustment period, it was important that continuing surveillance was exercised over the changes effected in Departmental organization and administration to assure the carrying out of the plan as originally intended. Responsibility for this task rests with the Division of Management Research.

Of primary importance during this period were the steps taken to relieve the Secretary of the Interior of the heavy load of personal supervision inherent in the former organization of the Department. The establishment of particular program areas as the responsibility of designated assistant secretaries and the under secretary provided a high level and effective means for the exercise of secretarial direction and supervision over the major programs of the Department. The success of this aspect of the reorganization plan was due in no small part to the provision of direct staff facilities for each of the program areas assigned to the assistant secretaries, viz, water and power, minerals and fuels, and land utilization and to the strengthening of the Program Staff and the Department Field Committee.

The Government-wide management improvement program, instituted early in 1950 by the President, continues today as a primary responsibility of the Division of Management Research and management planning staffs throughout the Department of the Interior. Representatives of the Division assisted bureau management planning staffs in the planning and conduct of their management improvement programs. Periodic reports were prepared in the bureaus and submitted to the Office of the Secretary for review and discussion with top officials of the bureaus. Written materials in the field of management improvement were furnished the bureaus and regular meetings on this subject were held with bureau representatives. By these means the Department of the Interior has been able to secure measurable and practical results in the conduct of its program for management improvement.

The Division of Management Research is collaborating with the Office of the Solicitor in the direction and supervision of a project to codify existing delegations of authority made by the Secretary and redelegations to subordinate levels made throughout the Department. The codification has a twofold purpose: (1) to comply with the Administrative Procedure Act; and (2) to provide a working tool for the appraisal of Departmental operations on the basis of information relating to the exercise of authority in the Department.

During the year the Division and the Program Staff collaborated with the Bureau of Mines in developing a complete programing system for all functions performed by the Bureau. The system includes long-range programs for specific minerals, annual programs, and work projects and forms the basis for planning all work to be done, fund requirements, and allotments necessary to carry on the work. It serves as a base for the entire management reporting system, also developed by the Bureau in collaboration with the Division. Initial steps were taken to develop a comparable system in the Geological Survey.

While no major organizational adjustments were made in the Department during the past year, a number of minor changes were effected. The most important of these related to the transfer of the minerals production and supply functions of the Defense Minerals Administration to the newly established Defense Materials Procurement Agency. The name of the Defense Minerals Administration was changed to Defense Minerals Exploration Administration and its functions limited to the encouragement of exploration and related development. The Division participated in the delineation of functions to be transferred; the clarification of the operating relationships with the Bureau of Mines and the Geological Survey; and the assignment of responsibility for administrative service operations for the Defense Minerals Exploration Administration.

An integral part of the management improvement program of the Department is the granting of incentive awards to employees in recognition of outstanding service and accomplishment in the conduct of their official duties. The activities of the incentive awards staff are under the general surveillance of the Director of Management Research. Awards are given for inventions, suggestions, superior accomplishment, and efficiency. They are given in cash, as within-grade promotions, or as honor awards.

The substantial savings that accrue to the Department as a result of this aspect of the management improvement program are illustrated by the following summary for the past fiscal year:

Number of suggestions received	1,216
Number of suggestions awarded	306
Amount of cash awarded	$11,572
Annual savings	$270,305
Superior accomplishment awards	136
Leading to savings	5
Amount of savings	$49,241
Efficiency awards approved	4
Annual savings	$2,889,250
Honor awards granted:	
Distinguished service	48
Meritorious service	92
Commendable service	272

DIVISION OF PERSONNEL MANAGEMENT

Guy W. Numbers, Director of Personnel

Perhaps the most significant movement in personnel management in the Department since the close of World War II has been toward decentralization of personnel authorities and functions. The size and spread of program activities, their distance from Washington, and the need for quick action, combine to make decentralization important.

The objective is to permit the allocation of responsibility for personnel actions to the field as close as possible to the base of operation. To this end some change in bureau organizational structures and staffing has been required, but the bureaus are gradually accomplishing this change and accepting more and more responsibility.

During the year there has been considerable progress toward the set goal. The bureaus, which had classification allocation authority through grade GS–13, were authorized to allocate finally all positions through grade GS–15. In the matter of appointments there was also an extension of authority. The bureaus and offices in Washington, which had appointing authority through grade GS–15, were authorized to redelegate limited authority to certain field installations.

In the field of wage-administration authority to approve wage rates for ungraded personnel, which had previously been delegated to officials in continental United States, was extended to officials in the territories and island possessions. Formal negotiations for labor-management agreements were entered into on several large-scale projects.

The training of the third group of departmental management trainees was brought to a conclusion in June 1952. Twenty-six trainees from nine bureaus and offices began the program in September 1951. Nine were new appointees from the junior management assistant register of the Civil Service Commission and seventeen were selected among the employees who had served in the Department a minimum of a year and demonstrated outstanding management potential. Twenty-three trainees successfully completed the program. In order to make it possible to increase the number of trainees each year and to further the objectives of the program in each bureau, steps have been taken to place more responsibility upon the bureaus for making selections and for conducting the training. A small bureau committee headed usually by an assistant director has been designated to select bureau candidates, supervise their training assignments, and generally sponsor the program.

Streamlining personnel operations so that they can be carried out by the operating officials as close to the actual operations as possible has been one of the Division's continuing endeavors. In an effort to provide the bureaus with proper guide lines in carrying out their gradually increased appointing authorities, a continuing study has been made of the Department's supplement to the Federal Personnel Manual.

Considerable progress has been made in unifying personnel policies for the Point IV Program in cooperation with the Division of International Activities of this Department and the Technical Cooperation Administration of the Department of State.

The Department's Interbureau Placement Committee (the Round Table) also continues to serve as an excellent forum for the discussion and recommendation of placement policies and for the development and streamlining of procedural matters. As an example of the latter, the committee has presented a revised departmental orientation plan, a project which required research and careful study.

In addition to its appraisal of personnel operations in Washington, it has been possible for the Division to expand its field reviews during the year. These surveys provide a means of (1) obtaining current and accurate information as to the effectiveness with which delegations of personnel authority are being discharged; (2) evaluating the scope and effectiveness of the bureau personnel programs as they meet the needs of the organization; (3) measuring the degree to which the programs conform to the applicable policies, standards, and procedures; and (4) furnishing advice and guidance in the interest of improving personnel-management practices.

The loyalty program of the Department is coordinated in this Division. All loyalty cases adjudicated by the Interior Department Loyalty Board have been processed here and the quarterly reports were prepared for the Loyalty Review Board.

In line with the objectives of the Federal Safety Council, better safety practices have been promoted throughout the bureaus. Also, the Department's health program has been furthered during the year.

With the view of clearing the way for greater staff service, a careful analysis of the Division's organization was made. Preaudit and postaudit of activities were eliminated where the bureaus had demonstrated competence in accepting full responsibility for performing the duties involved. The Branch of Employment has undergone a major reorganization. So far as possible the operations and case work which cannot be delegated to the bureaus have been segregated in a section of placement in charge of a chief placement officer.

Considerable progressive legislation in the personnel field was passed during the year. Of particular importance to all classified employees was the pay increase law providing pay increases retroactive to the beginning of the first pay period after June 30, 1951. In the interest of uniformity in salaries, the Third Supplemental Appropriations Act extended the retroactive pay increases to employees under the IGS schedule (Interior employees paid the same rates as those under the GS schedule). The new leave act provides that the number of years of Government service determines the amount of leave an employee earns during the year but is limited by the requirement that the leave earned in a calendar year be used by June 30 of the following year.

At the close of the fiscal year there were 60,677 compensated employees in the Department, of which 5,955 were in Washington, D. C., metropolitan area, and 54,722 located in the field. Of the total number 41,324 were classified by grade under the Classification Act, 15,957 under wage-board procedure, and 3,396 under other pay systems. Veterans in the Department now number 25,798. The number of women is 13,249.

There were 285 retirements in the Department during the year, of which 52 were for age, 161 were optional, and 72 were for disability.

DIVISION OF ADMINISTRATIVE SERVICES

Floyd E. Dotson, Director

The Division of Administrative Services furnishes all administrative services required by the Office of the Secretary. Service also available to all bureaus and offices of the Department includes library, museum, health, space, telephone, photographic, warehousing and shipping, duplicating, and printing and binding.

Branch of Library Services.—The central library of the Department was more widely used during the past year than at any other time in the Department's history. This same comment applies to the Geological Survey library and the library of the Division of Geography, both of which are under technical but not administrative supervision of the central library.

At the beginning of the third year of its operation, the central library is being used at a rate approximately 20 percent above that of the second year, during which year the rate was more than double that of the first year. Circulation outside the library totaled more than 16,000 books and 38,000 periodicals, while more than 25,000 items were used in the reading room. Three thousand items were loaned to other libraries. The reference and circulation staff received nearly 20,000 telephone calls and the reference staff handled approximately 23,000 questions. More than 25,000 individuals visited the library.

More than 15,000 volumes of books were added and cataloged in addition to more than 43,000 items of periodicals.

Branch of personnel operations.—This branch continued to furnish service to the component divisions and staff areas of the Office of the Secretary in matters pertaining to personnel problems. The activities of the branch have included basic responsibilities in connection with position classification, wage administration, recruitment, appointment, placement, training, performance ratings, employee relations, processing, reporting, and other related phases of a personnel program operating at a bureau level.

Branch of Fiscal and Special Services.—This branch performs the regular budget and accounting functions for the Office of the Secretary and is responsible for the control of funds transferred or appropriated to the Office of the Secretary for activities carried on by more than one bureau. These include funds for the control of forest pests, the Point 4 program and the Defense activities.

Expenditures for the Office of the Secretary were approximately $4,500,000. There was also received, as income from leases and royalties on submerged lands, more than $17,000,000 which was deposited in a special account.

Records Management.—During the fiscal year the records management program for the Office of the Secretary produced the following results:

Eleven hundred nineteen cubic feet of obsolete records were disposed of as waste paper; 500 cubic feet of historically valuable records were transferred to the National Archives for permanent preservation; 740 square feet of office space were released for other uses; work was begun on the development of a standard filing classification pattern which will fit the needs of all divisions with the Office of the Secretary;

arrangement made for the transfer of approximately 1,800 cubic feet of inactive but administratively valuable records to the Alexandria Records Center.

Museum.—The Department's museum is a facility used to help visualize to the public "the history, aims and current activities" of the Department, and is the repository for collections of material of historic significance in the field of conservation and development of national resources.

More than 30,000 persons visited the museum last year, coming from every State in the Union, the Territories, and 59 foreign countries.

Special exhibits are frequently shown and additions to the regular exhibits are made as frequently as possible.

Among the groups interested in the conservation activities of the Department are the teachers in public and private schools, many of whom have visited the museum.

Branch of Central Services.—No change has occurred in the responsibilities of this branch and it continues to furnish the operational management of central duplicating service, communications service for the Department and other agencies, a health-service program, photographic service for the Department, procurement for the Office of the Secretary, warehouse and shipping service and printing and binding service for the Department.

The purchase of certain new items of equipment have modernized the facilities of both the Duplicating Section and the Storage and Shipping Section, and the installation of a 17-inch by 22-inch press in the Duplicating Section has changed the classification of that function from a class A to a class B plant.

PETROLEUM ADMINISTRATION FOR DEFENSE

J. Ed Warren, Deputy Administrator[1]

Fiscal 1952 saw a multitude of problems in oil and gas supply confront the free world in general, the United States in particular. To review the history of the year is to list successive crises.

There was the shutdown of Iranian production of crude oil and products as a result of the controversy over nationalization of Iran's oil. That shutdown threw free-world petroleum supplies into dangerous imbalance.

There was a threatened shortage of natural gas to supply defense and essential civilian needs. Demands for gas were expanding rapidly, but because there was a shortage of pipe, some of the necessary transmission lines could not be laid in time to meet those demands.

Disparities between Gulf and East Coast ceiling prices and high tanker rates threatened a shortage of heating oils on the Atlantic seaboard.

Work stoppages in more than one-third of the Nation's refineries during May created an immediate problem of shortages of aviation gasoline and other products, a long-range problem of possible general shortages.

Yet despite strains and occasional dislocations the minimum requirements, military and civilian, of the United States and the other free nations for petroleum and its products were met throughout fiscal 1952.

Twenty divisions of PAD cooperated in the accomplishment—11 operating divisions concerned with domestic petroleum operations, foreign petroleum operations, and gas, and 9 general service divisions and offices. But there were many other agencies that helped mobilize the oil and gas industries to meet the continuing challenge. An interagency Foreign Petroleum Committee was involved, and so were the Oil and Gas Division of the Department of the Interior, the National Petroleum Council, the Gas Industry Advisory Council, the Military Fuels General Advisory Committee, the Military Fuels Technical Advisory Committee, the Interstate Oil Compact Commission, the various State regulatory bodies, and others.

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[1] Mr. Warren succeeded the first Deputy Administrator of the agency Bruce K. Brown, on May 29, 1952.

FOREIGN PROBLEMS

On June 20, 1951, all Iranian production of crude oil and products was closed off to the free world. This meant, among other things, the loss of 18,400 barrels a day of aviation gasoline, 95,500 barrels a day of distillate oils, and 210,000 barrels a day of residual fuel oil.

From its beginning PAD has been working on a mechanism to help it deal with foreign problems of this kind. On June 25 it put the mechanism into operation—a voluntary agreement under which 19 United States companies with operations abroad could cooperate in solving supply problems. On July 26 a plan of action designed specifically for the Iranian crisis was put into effect. This plan permitted various transactions of trade and sale among the 19 companies at Government direction to help avert some of the more serious consequences of the closing in of Iranian production.

Committees appointed by the Secretary of the Interior or the Deputy Administrator of PAD under the agreement and the plan of action collected information on all phases of foreign petroleum operations. They also recommended schedules of transactions to cover the Iranian-caused losses, and those schedules approved by PAD became a directed order of business.

To the end of June 1952, approved schedules covered the movement of approximately 45,000 barrels of crude oil and products diverted from normal trade channels. A detailed report of the activities of the committees through December 31, 1951, has been submitted to the Secretary of the Interior and distributed to all interested Federal agencies.

The end of the year found free-world petroleum supplies and demands in rough balance, though shortages still threatened in aviation gasoline, some heating oils, and residual fuel oil.

PAD's Assistant Deputy Administrator in charge of Foreign Petroleum Operations is the United States representative on the Petroleum Planning Committee of the North Atlantic Treaty Organization and is a special consultant to the United States Ambassador at Large to NATO.

DOMESTIC PROBLEMS

During the year PAD faced four major crises in addition to the continuing problem of insuring that enough materials were available to the oil and gas industries and such special problems as assuring a supply of Navy special fuel oil to erase a West coast shortage that threatened the Navy:

1. In the summer of 1951 it became obvious that some of the new pipelines that were needed to provide natural gas to meet rapidly expanding demands would not be completed before the peak winter season. There was, then, a possibility that, if expansion of natural-gas uses went unrestricted, some areas of the country would face a natural-gas shortage during the winter. Essential defense industries might have their gas supplies cut off; house-heating customers might have to go cold. To avert the threatened shortage the Petroleum Administration issued PAD Order No. 2, an order designed to slow down the extension of natural-gas uses in areas where pipelines were inadequate to care for unrestricted demand. The order puts limits on extension of new service to space-heating customers and requires specific PAD approval for extensions to large-volume consumers in the areas in which it is effective—Connecticut, Delaware, the District of Columbia, Massachusetts, Michigan, New Jersey, New York, and Rhode Island.

2. Military requirements for high octane-number aviation gasoline became increasingly difficult to meet as the summer wore on. To boost the available supplies of aviation gasoline PAD issued two orders. One, PAD Order No. 3, prohibits the use of alkylate and certain other blending agents in anything but aviation gasoline and requires the use of available raw materials for production of alkylate as directed by PAD. The second, PAD Order No. 4, puts a floor on the amount of tetraethyl lead to be used in the manufacture of aviation gasoline—4 cc. for each gallon to be used by domestic airlines, 4.6 cc. for each gallon to be exported.

3. Winter's approach focused attention on the problem of home-heating oil for the East coast. Many distributors found themselves unable to buy this oil on the Gulf coast at prevailing ceiling prices, pay high freight rates for tanker hauls to the East coast, then sell the oil at East coast ceilings. Several schemes for breaking this economic deadlock were explored and discarded. Finally PAD called on the oil industry to enter a voluntary agreement to make up the prospective shortage. Twelve companies agreed to cooperate in supplying the oil and representatives were appointed to an East coast supply committee for that purpose. At PAD direction they supplied 1,700,000 barrels of heating oil and kerosene to avert shortages in the Boston, New Haven, and New York areas.

4. Loss of some 35 percent of the Nation's capacity to turn out petroleum products as a result of work stoppages in refineries throughout the country presented a new problem in May. PAD promptly

issued two orders dealing with products shortages. PAD Order No. 5 put limits on the inventories of all products except aviation gasoline that resellers and certain large-volume consumers could maintain and prohibited export of these products without PAD approval. PAD Order No. 6 banned sport and pleasure flying, restricted all other flying to use of 65 percent of the gasoline used in March, and prohibited export of aviation gasoline without PAD approval. These two orders were promptly canceled upon the end of the stoppages.

FUTURE OPERATIONS

As both military and civilian demands for petroleum products increased during the year, it became obvious that the Nation needed for its safety greater reserve capacity for producing, refining, and transporting crude oil. At the beginning of World War II the United States had a reserve productive capacity equal to 34 percent of its daily consumption of petroleum. That reserve proved invaluable in face of the quickly expanding demands that were imposed. In 1952, the reserve capacity of the Nation was only about 10 percent of consumption, a dangerously low level.

Early in calendar 1952 the Petroleum Administration proposed additional expansion for the petroleum industry over an 18-month period beginning in July 1952. In April the Defense Production Administration approved this program. It calls for the drilling of 80,000 wells in the United States over the 18 months—25,000 during the last half of calendar 1952 and 55,000 during 1953. It calls for expansion of basic refining capacity at the rate of 500,000 barrels per day per year over the period of the program. It calls for expansion of transportation and storage facilities, natural-gasoline production facilities, and other parts of the industry in keeping with these primary goals.

From June 13, 1951, through June 28, 1952, PAD received more than 4,000 applications for permission to complete or construct oil or gas projects valued at $4,343,950,604. From September 23, 1950, to the end of June 1952, it had received applications for accelerated tax amortization covering 1,338 projects in the oil and gas industries. The agency recommended approval of accelerated amortization on 52 percent of the $2,689,486,000 cost of 948 of these projects. Recommended facilities would increase the basic refining capacity of the Nation by 1,390,000 barrels a day, the natural-gasoline processing capacity by 216,000 barrels a day, the lubricating-oil production capacity by 15,000 barrels a day, the lube-oil additive production capacity by 10,900,000 pounds a month. Recommended storage projects would provide space for 39,598,000 barrels of crude oil and products, 2,323,000 barrels of natural gasoline, 300 million cubic feet of natural gas. Recommended pipeline projects would provide capacity for transportation of 3,089,000 barrels a day of crude oil and products, 644,358 million cubic feet a day of natural gas.

PAD to the end of the fiscal year had received 49 applications for Government financial aid under section 302 of the Defense Production Act of 1950 as amended. The agency recommended nine of these to DPA for issuance of a letter of essentiality, recommended denial of 31 others. Six of the applications were withdrawn, and three others were still under PAD review at the year's end. Eight of the nine recommended projects involved storage of petroleum products essential to the Armed Services Petroleum Purchasing Agency. The other was a project for rehabilitation of an alkylation plant needed in production of aviation gasoline.

During the year PAD made constant use of the services of the National Petroleum Council (the council made 14 technical studies during the year) and the Gas Industry Advisory Council. Until January 7, 1952, it also made use of the Military Petroleum Advisory Board, which had been established at the request of the Defense Department. On that date, however, by amendment 1 to order No. 2562, the functions of the MPAB were transferred to PAD itself. This order preserved the board as a stand-by ready to be brought into action in the future. On February 15, 1952, the Deputy Administrator of the agency appointed a Military Fuels General Advisory Committee and a Military Fuels Technical Advisory Committee to help carry out the functions assigned to it.

DEFENSE SOLID FUELS ADMINISTRATION

Charles W. Connor, Administrator

During the fiscal year ending June 30, 1952, the Defense Solid Fuels Administration carried on a number of vital programs to aid the solid-fuels industries to achieve the output of coal, coke, and coal chemicals required to meet the needs of the defense mobilization program. The output of metallurgical coal and coke was increased to meet the growing demand created by the steel expansion program, and the augmented coal requirements of rapidly expanding industries, such as the electrical utility industry, as well as record export demands, were met on schedule. Progress was made toward meeting the expansion goals for coke and metallurgical coal capacity, although on July 1, 1952, a substantial portion of the new construction required to meet the coke expansion goal remained to be completed.

COAL-MINE MAINTENANCE AND CONSTRUCTION

During the fiscal year, the Defense Solid Fuels Administration authorized and distributed controlled materials for 186 coal-mine construction projects costing about $169,000,000. The division of the projects among the various States follows: Alabama, 11 projects, $19,681,500; Colorado, 3 projects, $5,629,750; Illinois, 15 projects, $22,864,696; Indiana, 9 projects; $3,217,330; Kentucky, 19 projects, $6,810,576; Missouri, 1 project, $290,000; Ohio, 6 projects; $5,679,500; Pennsylvania, 60 projects, $77,564,822; Tennessee, 2 projects, $128,750; Utah, 7 projects, $3,032,155; Virginia, 3 projects, $278,657; West Virginia, 49 projects, $22,859,014; Territory of Alaska, 1 project, $503,044.

The needs of coal producers for materials for maintenance, repair, and operating supplies as well as new construction were met satisfactorily. Under a self-rating system of priority assistance developed by the DSFA and put into effect on October 24, 1951, producers were enabled to obtain the operating supplies they needed under a standard quota system, subject to special adjustments in hardship cases. DSFA also provided priority assistance to producers for major capital additions. Ratings initiated for this purpose totaled $25,582,590.

COKE-OVEN CONSTRUCTION PROGRAM

On December 18, 1951, the expansion goal for oven coke was set at 84,000,000 net tons by January 1, 1954. This called for an increase of 10 million net tons over the 1951 capacity. During the 1952 fiscal year, ovens were put in operation with an annual coking capacity of 6,423,000 tons. The capacity lost through the dismantling of over-age ovens, however, totaled 2,955,000 tons, leaving a net gain in capacity of 3,468,000 tons.

The demand for metallurgical coke is expected to increase rapidly in the 1953 fiscal year and coke is expected to be in tight supply after the maximum impact of the blast-furnace programs occurs in the late spring of 1953. Curtailment of less essential uses and distribution of available high-grade coke to defense programs by DSFA directive action may become necessary until production can be brought into balance with requirements.

In an effort to prevent a serious coke shortage, DSFA is working with industry in carrying out one of the largest coke oven construction programs on record. DSFA has provided construction permits, ratings, and controlled materials for 117 coke-oven construction projects costing about $480,000,000. Special priority assistance for component parts costing $878,793 was initiated in 48 instances.

Efforts are also being made to increase wherever possible the coal chemical output of the coke industry. A careful survey of the benzol production facilities of all operating coke plants during the year indicated that benzol production at these facilities will reach about 186 million gallons.

A close check is also being kept by DSFA on petroleum coke supply and demand factors. A survey during the year of all producers and users of both green and calcined petroleum coke indicated that there was ample production of both types to take care of all requirements, including the programed expansion of the aluminum industry.

INDUSTRY FINANCE

Through June 30, 1952, certificates of necessity for rapid tax amortization of essential coal and coke facilities were certified for 88 projects costing about $345,000,000. The 38 coal projects certified, costing about $60,000,000, will provide, when completed, a metallurgical coal capacity of about 11,700,000 tons. The 50 approved coke projects, costing about $285,000,000, will have an annual capacity of about 6,700,000 tons. Applications totaling $121,000,000 were denied. At the end of the fiscal year, 40 applications for rapid tax amortization, totaling $283,000,000, were being processed.

Of 22 applications received for loans totaling $24,600,000, 3 were withdrawn, 10 were denied, and 2 were approved. The approved loans provide $2,200,000 for beehive ovens in Pennsylvania and $426,000 for a 120,000-ton capacity underground coal-mine operation in the Matanuska field of Alaska. Several other loans for coal expansion projects in the Territory of Alaska, where military coal requirements are rapidly increasing, were being reviewed at the end of the fiscal year.

DEFENSE ELECTRIC POWER ADMINISTRATION

James F. Fairman, Administrator

DEPA entered the fiscal year 1952 with an electric power expansion program of 27,600,000 kilowatts for the calendar years 1951, 1952, and 1953, which is barely enough energy to provide for the estimated additional capacity required by the defense program alone, and with materials allotments for the third quarter of 1951 for field construction and manufacture of equipment reduced to a crippling degree below the quantities required to achieve that goal. It was evident that DEPA would have to obtain clearer recognition by defense officials generally of the basic and vital role of adequate electric generating capacity in the "guns and butter" economy.

Both public and private power groups cooperated wholeheartedly with DEPA in efforts to remove the general misunderstanding that the way to meet a power shortage is to curtail so-called nonessential or civilian uses. The catalyst that produced the first tangible results of our combined efforts was the curtailment order DEPA found it necessary to issue for the Pacific Northwest in September 1951. This curtailment clearly demonstrated that a substantial saving of electric energy can only be obtained by interrupting large loads, which include such defense production as aluminum. Other minor curtailments were experienced in Texas, Alaska, and in the Southeast.

In order to obtain impartial advice on the power expansion program, which had increased to 30,000,000 kilowatts in the calendar years 1952, 1953, and 1954, the Defense Production Administrator on October 3, 1951, appointed an Electric Power Advisory Committee to study the power situation and recommend an electric power construction program that would supply the defense needs and the needs of the civilian economy. At approximately the same time the Joint Committee of the Congress on Defense Production, commonly called the

Maybank committee, ordered an investigation of the electric power program.

DEPA, in providing information for the two committees, held meetings throughout the country with power suppliers where load estimates were compiled and analyzed. A comprehensive report of the information obtained and conclusions as to the implications of the data, was prepared and submitted for the use of the two committees.

Based upon this report and other information obtained independently by the committees from various other sources, the Electric Power Advisory Committee reported, "The 30,000,000 kilowatts of new capacity now planned by the electric systems of the country to meet the demands (including necessary minimum reserves) is not in the aggregate excessive. If anything, the total capacity is too small." The Maybank committee report pointed out the resulting effects upon the power expansion program of inadequate allotments of materials and the necessity for early planning because of the long lead time required in power generating installations. DEPA concurred in the conclusions of the two committees but questioned, in view of previous and prevailing rates of materials allotments and long lead times required, whether it would be possible to achieve the established goal for additional capacity by 1954.

On March 22, 1952, DPA announced approval of an expansion goal of 32,000,000 kilowatts for the years 1952, 1953, and 1954. On April 7, DPA announced the formation of the Electric Power Coordinating Committee with the Administrator of DEPA as chairman, and with the Deputy Administrator of the National Production Authority and the director of the construction division of DPA as the other members, for the purpose of giving top-level assistance in reaching the power expansion goal.

As of April, it became clear that the allocation of insufficient materials and the inability of utilities and power equipment manufacturers to place firm delivery orders for materials during 1951 would cause a loss of nearly 2,000,000 kilowatts of the 9,000,000 kilowatts planned for 1952. Just prior to the steel strike in June, with the cooperation of DPA and NPA, it appeared that adequate allocations and deliveries would be made so that no further slippage was expected. It is still too early fully to evaluate the impact of the steel strike but it appears that the combined effect of too little materials in 1951 and the steel strike in 1952 will result in the installation of not more than 29,000,000 kilowatts by 1954 instead of the planned 32,000,000 kilowatts providing there are no further work stoppages or similar contingencies during that period.

Resurveys of the power supply situation have been conducted by DEPA indicating the need of further expansion of the program.

DEPA cooperated with the FPC in the collection of power supply data and its analysis to determine where exemptions would encourage desirable interconnections to handle rapidly growing defense loads. Relatively few areas of bottled-up power supply have been found but transmission reinforcements have been made which further integrate electric utilities into four great power pools: (1) the Northwest, (2) the Southwest, (3) the Midwest and Southeast, and (4) the Northeast. To date, potential power shortages have only evidenced themselves in the northwest, south central, and southeastern regions due to unusual rates of load growth in these areas.

On May 28, 1952, E. Jason Dryer, General Counsel of DEPA, was appointed Deputy Administrator to succeed John D. Davis who became Deputy Administrator of the Bonneville Power Administration.

DEFENSE FISHERIES ADMINISTRATION

Albert M. Day, Administrator

In discharging its responsibility for maintaining adequate fish production, the Defense Fisheries Administration during the fiscal year 1952 adhered to its policy of anticipating the fishery industry's emergency material, manpower, and other production needs and, insofar as possible, correcting causes of potential problems before actual problems arise. In accomplishing this, DFA's small staff furnishes representation on many committees and is active in liaison with, and in an advisory capacity to, other agencies and the industry. Of particular importance is DFA's membership on 14 commodity and equipment requirements committees of the National Production Authority, at meetings of which the fishery industry's viewpoints are presented and its essential requirements of materials and equipment are justified. DFA also works closely with the Department of Agriculture, Office of Price Stabilization, Wage Stabilization Board, Salary Stabilization Board, Defense Transport Administration, Selective Service System, Department of Labor, Department of Justice, Reconstruction Finance Corporation, Small Defense Plants Administration, and others, in the interest not only of advising on specialized fishery problems but assuring the fishery industry full recognition in any applicable actions these agencies may take.

Much of DFA's workload, such as preparation for attendance at committee meetings and the assembly and analysis of data necessary for taking actions, giving advice, and making recommendations on defense fisheries matters, cannot be statistically summarized. However, a number of actions taken by DFA during the fiscal year 1952 are itemized as follows: 82 cases of spot assistance for obtaining materials, supplies, or equipment; 8 actions on formal requests for certificates of necessity; 4 actions on formal requests for Government loans; 22 actions on requests for information on criteria regarding Government loans; 63 actions on requests for aid in deferment of draft registrants, etc.; 43 actions on requests from OPS for data and analyses to be used in connection with price ceilings; 39 cases of assistance in wage and labor disputes; and 24 studies of proposed military restricted areas in localities of interest to the fisheries.

Several reorganizations of DFA occurred during the fiscal year 1952, each of which resulted in economies of operation. The program for 1953 will be a continuation of that for 1952, with the pressure of controls under which the industry must operate being the guide for DFA actions which may be necessary.

DEFENSE MINERALS EXPLORATION ADMINISTRATION

C. O. Mittendorf, Administrator

The Defense Minerals Exploration Administration is responsible for carrying out a program to discover and develop in the United States and Territories additional deposits of all the strategic metals and minerals so critical to our national security.

The establishment of this minerals exploration assistance program is based on the principle that private mining interests, whether large or small, be encouraged to share in the responsibility of finding and developing these vitally needed mineral ore reserves. Thus, the Government, through the DMEA, offers to the mining industry, and particularly the small operators, financial aid on a share-the-cost basis of 50 percent, 75 percent, or 90 percent in the cost of an exploration project, the actual amount being determined by the strategic need of the mineral sought, and the chance of its discovery and development in commercial quantities.

Early in the fiscal year the exploration program was part of the operations of the Defense Minerals Administration. The DMA was established in December 1950 by the Secretary of the Interior, in accordance with the Defense Production Act of 1950, as amended, for the maintenance and increase of production (and supplies) of strategic metal and minerals. The DMA also was charged with administering an exploration program.

This organizational arrangement continued until August 28, 1951, when the Defense Materials Procurement Agency was established by Presidential order. Subsequently, effective October 28, 1951, the Bureau of the Budget issued orders of determinations and dispositions which formally transferred all DMA functions and personnel, with the exception of those concerned with exploration, from DMA to DMPA. This followed a pattern set on September 14, 1951, when

DMPA redelegated to the Secretary of the Interior responsibility for continuing and expanding the minerals exploration program under DMA.

On November 20, 1951, the Secretary of the Interior changed the name of Defense Minerals Administration to Defense Minerals Exploration Administration and designated C. O. Mittendorf, who had been acting administrator of DMA, to be acting administrator of the newly named agency, reporting direct to the Assistant Secretary for Mineral Resources.

This series of changes resulted in major organizational problems. In DMEA there are provisions for only four commodity divisions to process exploration applications, where there had been seven under DMA. Technical personnel had to be recruited; files and records reviewed and transferred (to DMPA); procedures revised and procedural instructions set up, and other operational functions established.

Once its major problems of organization had been solved, DMEA took definite steps to expedite the program. The form for application for aid in an exploration project (MF–103) was revised for the purpose of simplification, to eliminate all but the most essential requirements for information, and to coordinate the information required with the provisions of the contract form. At the same time the contract form (MF–200) was revised to make its provisions more explicit, to resolve some ambiguities, and generally to render it more adaptable to the needs both of the Government and of the operators. A new short form contract (MF–200A) was added for use in connection with projects that can be administered more effectively on a basis of agreed unit costs rather than actual costs, thus eliminating the necessity for cost accounting.

As further protection to the Government, and in conformance with General Accounting Office procedures, an audit division was established. DMEA located auditors in Denver, San Francisco, and Spokane to discharge the agency's responsibility of making final audits and determining the propriety of payments made under the terms of the exploration contracts.

At the beginning of the fiscal year, while operating as DMA, a total of 720 exploration project applications had been received from mine operators, and 24 of them developed into executed contracts having an aggregate Government participation of $1,497,918. In the subsequent 12 months, 691 more applications were received, bringing the total to 1,411, and 291 more contracts were executed for a total of 315, involving Government contributions amounting to $9,403,629.

In the period from December 1—soon after the agency was officially designated DMEA—until the end of the fiscal year, 391 applications were received and 145 contracts executed.

As of June 30, 1952, DMEA has issued 12 certifications for discoveries or developments of deposits of tungsten, monazite, mica, beryl, manganese, sulfur, and lead-zinc-copper. The first certification of discovery or development was made in March. This was for mica in North Carolina. Five of the 12 certifications involved mica; 3 of these for strategic mica in North Carolina and 2 for mica and beryl in South Dakota. Of the remaining seven, two were for tungsten in California and Montana, two for manganese in Arkansas, and one each for monazite in Idaho, sulphur in Wyoming and lead-zinc-copper in Colorado.

The total contract amounts of the projects certified was $216,126, and although the Government's participation was set at $143,800, several of the operators completed their work at less than the estimated cost and the Government actually spent only $107,126. This amount, however, is repayable on a percentage-royalty basis from the net receipts from any ore shipped by the operators.

Twenty-seven contracts, under which actual exploration work was done, were terminated without certification of discovery or development. The estimated costs under these 27 terminated contracts originally totaled $329,270 with Government participation set at $232,669; but actual cost to the Government was only $101,008. These negative results have value in that the areas involved are removed from future consideration and expense of exploration.

Consideration should be given to the work of handling the hundreds of applications which were denied, and those withdrawn. Every application required analysis and study by mining experts and, in a majority of cases, on-site investigations by members of the DMEA field teams. A total of 544 applications were considered and denied, most of them because of the improbability of discovery of commercial deposits. Two hundred and three applications were withdrawn by applicants.

A marked decrease in the number of new applications occurred during April, May, and June of 1952. This trend was contrary to estimates by field teams in March and was attributed to the fact that 44 percent of all contracts were for lead-zinc and lead-zinc-copper projects, and a sharp drop in the price of lead-zinc caused an abrupt braking of exploration for these metals.

However, the search for additional domestic deposits of strategic and critical minerals and metals continues. Under the DMEA program, exploration projects are being carried on in 27 States. Twenty-four minerals are being actively sought, including rutile (used in making welding rods) and brookite, a possible substitute for rutile, which were added to the critical list in January 1952.

With its relatively small force, aided by the cooperation of the Bureau of Mines and the Geological Survey, the DMEA has a leading part in solving the problem of determining the future mineral resources of the United States.

The defense minerals exploration activity is little more than a year old and its accomplishments cannot be fairly evaluated at this time. Experience has shown that the average time for completion of an exploration project is about a year. Thus, if we are to have any substantial results from DMEA's program, it must be regarded as one of comparatively long range.

The response by mining operators is praiseworthy and the activities of other Government agencies, such as establishment of purchase depots so far for manganese, chromite, mica, and tungsten; the development of new techniques for use in finding and developing ore deposits, and the progress made in devising methods for utilizing marginal and submarginal ores at low costs, should help accelerate future exploration.

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